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AN EVALUATION OF SPARES ACQUISITION INTEGRATED WITH PRODUCTION

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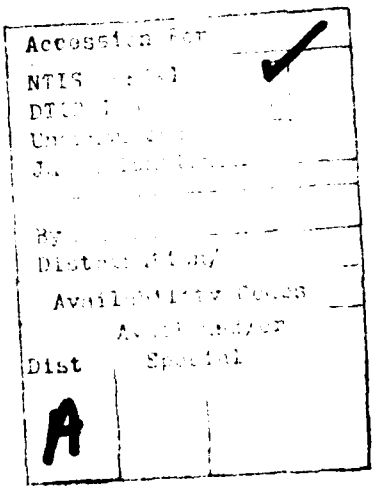

EXECUTIVE SUMMARY

Spares Acquisition Integrated with Production (SAIP) is the concurrent procurement of items to serve as spares and items to be installed as components of weapon systems. It makes eminently good sense. It is cost-effective during initial provisioning and may remain so throughout weapon-system production. The two most important characteristics of SAIP that support this conclusion are:

1. SAIP results in lower unit prices, not only for spares but also for components to be installed during production (production installation items).

2. SAIP enhances the timely availability of spares, and thus weapon-system readiness.

The current DoD practice is to order spares as late as possible, i.e., a procurement leadtime ahead of their need date. The result is that (1) spares and production installation items are procured on separate contracts by separate contracting agencies (the prime contractor and the Government), (2) the administrator of the spares contract does not know the cost of the production installation items, and (3) extraordinary measures must often be taken to ensure that the spares are delivered in the same configuration as the production installation items. These circumstances often result in separate production runs, with all the associated redundancies and inefficiencies.

In contrast to the conventional approach, SAIP achieves lower unit prices by (1) avoiding redundant set-up costs by reducing the number of separate production orders, (2) taking advantage of economies of scale by increasing the average production lot size per order, and (3) taking greater advantage of learning. SAIP also reduces administrative costs by reducing the number of

separate contracts; it aids configuration control; and it inhibits "buying in."

The principal risk associated with SAIP is the presumed need to order spares earlier, thus increasing the likelihood of additional retrofit costs; however, in many programs SAIP procurements do not have to be made significantly in advance of leadtime-away procurements.

In recent years, procurement leadtimes have increased dramatically on many weapon-system components and spare parts, especially those incorporating critical materials that are in short supply world-wide. As a result, advance procurement of long-leadtime spares is often required prior to the fiscal year in which the related end item is to be procured. However, approval of funding of long-leadtime spares has been complicated by current policy and, to the extent that SAIP results in earlier procurement, it may aggravate that problem.

The initial provisioning of some systems occurs as much as four years after the system is introduced. Because of this, an item may be coded for breakout from the prime contractor prior to its being initially provisioned. The cost-effectiveness of early breakout is questionable, given SAIP as an alternative, since SAIP can yield substantial cost savings and is clearly best implemented through the prime contractor. The prices of spares procured through the prime contractor depend largely on the prime's pricing policies; therefore, the cost-effectiveness of spares procurement through the prime must be assessed on a case-by-case basis.

Separate contracts for spares and production installation items are the rule in the Air Force. Although the law prescribes separate funding for these two classes of item, we do not see the need for more than one contract when using SAIP.

The use of a contingency charge to cover design change costs, when based upon analysis of historical design change costs and when properly imbedded in the contractor's cost accounting system, seems reasonable. Such a charge would obviate the need to renegotiate the price of an item after every design change. It should reduce expense to the Government.

We recommend that the Office of the Secretary of Defense:

1) Require evaluation of SAIP for the initial provisioning for all major weapon-system acquisition programs.

2) Revise DoD Directive 4140.40 to allow the concurrent procurement of spares and production installation items,

3. Require evaluation of SAIP for replenishment provisioning, in conjunction with the economic analysis undertaken to decide whether procurements should be broken out from the prime contractor,

4. Revise DoD Directive 7200.4 to allow the advance procurement of long-leadtime spares prior to the fiscal year in which the related end item is to be procured.

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1. INTRODUCTION

PURPOSE

Spares Acquisition Integrated with Production (SAIP), as applied to weapon systems, is a policy that could save the U.S. Government a considerable amount of money. SAIP is a spares procurement technique whereby spares for a weapon system are ordered concurrently with components required for installation in the system during production (production installation items). The current technique for acquiring spares throughout the DoD is to order them as late as possible, i.e., a procurement leadtime ahead of their need date; therefore, the typical order for spares is not placed concurrently with the prime contractor's order for production installation items since his need date tends to be slightly different from the Government's. In this report, SAIP is defined to be the concurrent ordering by the prime contractor of spares and production installation items where there exists a contractual clause requiring the spare to be delivered in the same configuration as the corresponding component in the delivered end item. Variations of this definition are discussed in later chapters. Ideally, perhaps, the manufacture and delivery of the spares would be interspersed with the manufacture and delivery of the production installation items, thereby ensuring that, in the event of a configuration change, the numbers of spares in the old and new configurations would be approximately correct; the procurement of spares and production installation items would be made with a single contract; and the procurement of Government-specified quantities would be made by the prime contractor. Variations of SAIP include variations of all of these characteristics; i.e., all of the spares associated with a particular block of end items might be

delivered on a specified lay-in date; the procurement might be made with more than one contract; and the Government might place an order for spares directly with a vendor at the same time as the prime contractor does.

We are using the standard DoD definitions for provisioning (initial and follow-on), reprovisioning, spares and repair parts. However, we are defining the demand development period (DDP), as the period from the introduction of a new end item until demand or usage data are first used in computatons for replenishment spares. We are also referring to spares and repair parts purchased through the prime contractor by the Government as CFS (contractor furnished spares). CFE should, therefore, be taken to mean contractor furnished equipment for production installation purposes. These and other more familiar definitions are contained in Appendix A.

The SAIP concept originated with the McDonnell Aircraft Company and was developed in 1974 by the Air Force. There have been several studies on weapon system support that have made mention of the Air Force's SAIP program: most notably the General Accounting Office [8], and the Defense Audit Service [2] studies. The former study lauded the SAIP concept as being cost-effective and recommended that DoD rescind policies that do not allow the use of SAIP. The latter study pointed out the ineffectiveness of two Air Force SAIP applications in achieving fair and reasonable prices. There have been other studies on both sides of the issues to which we will refer throughout this report.

This study examines the issues surrounding the concurrent ordering of spare parts with installation items. In the course of the study we have gathered information on several programs in order to understand the particular variations or SAIP that have been tried and their degrees of success. Additionally, we have gathered data on several weapon systems that either refute or support the benefits and risks that are claimed by both the proponents and

opponents of the SAIP concept. The insights gained from our analysis of past applications suggest ways in which a SAIP strategy might be implemented within DoD.

BACKGROUND

SAIP applications have generally included configuration control clauses requiring that spares be delivered only in the proper configuration, that is, in the configuration of the installed items. SAIP is best applied to orders made through the prime contractor, although this does not have to be the case.

During a new end item's initial period of service it is customary for many of the spare and repair parts to be ordered through the prime contractor. These initial spare and repair parts are, therefore, natural candidates for a SAIP application. Thus, the primary distinction between SAIP and conventional initial provisioning of contractor furnished spares (CFS) becomes a matter of when the order is placed, not with whom the order is placed. We will show (in Chapter 3) that there are other advantages (and risks) associated with SAIP not generally present with conventional initial provisioning.

Initial provisioning can conceivably take place at different points in time for different end item programs. For example, we have observed programs for which initial provisioning covers the first two years of a new system's operation, and others for which the initial provisioning period covers the third through fourth years of operation. The key determinant in the timing of initial provisioning appears to be the date of initial operational capability (IOC). Prior to IOC, support of the end item may be provided through contractual arrangements such as interim contractor support (ICS) or phased provisioning, or through dependence on the contractor's production line assets.

Figure 1-1 shows three alternative strategies for supporting a new end item for an initial period of time. The timing of possible SAIP procurements is also illustrated. We are using the term contractor support in the spirit of DoD Directive (DoDD) 4140.40 in which the contractor provides all support items. SAIP, as we have defined it, can take place when (1) the Government has made a decision to buy the support items outright, or (2) the Government has decided to buy the support items through the prime contractor. We do not wish to imply that SAIP works only through the prime contractor; we just wish to remind the reader that we are examining this particular form of SAIP. Variations and extensions of our definition of SAIP are discussed in a later chapter.

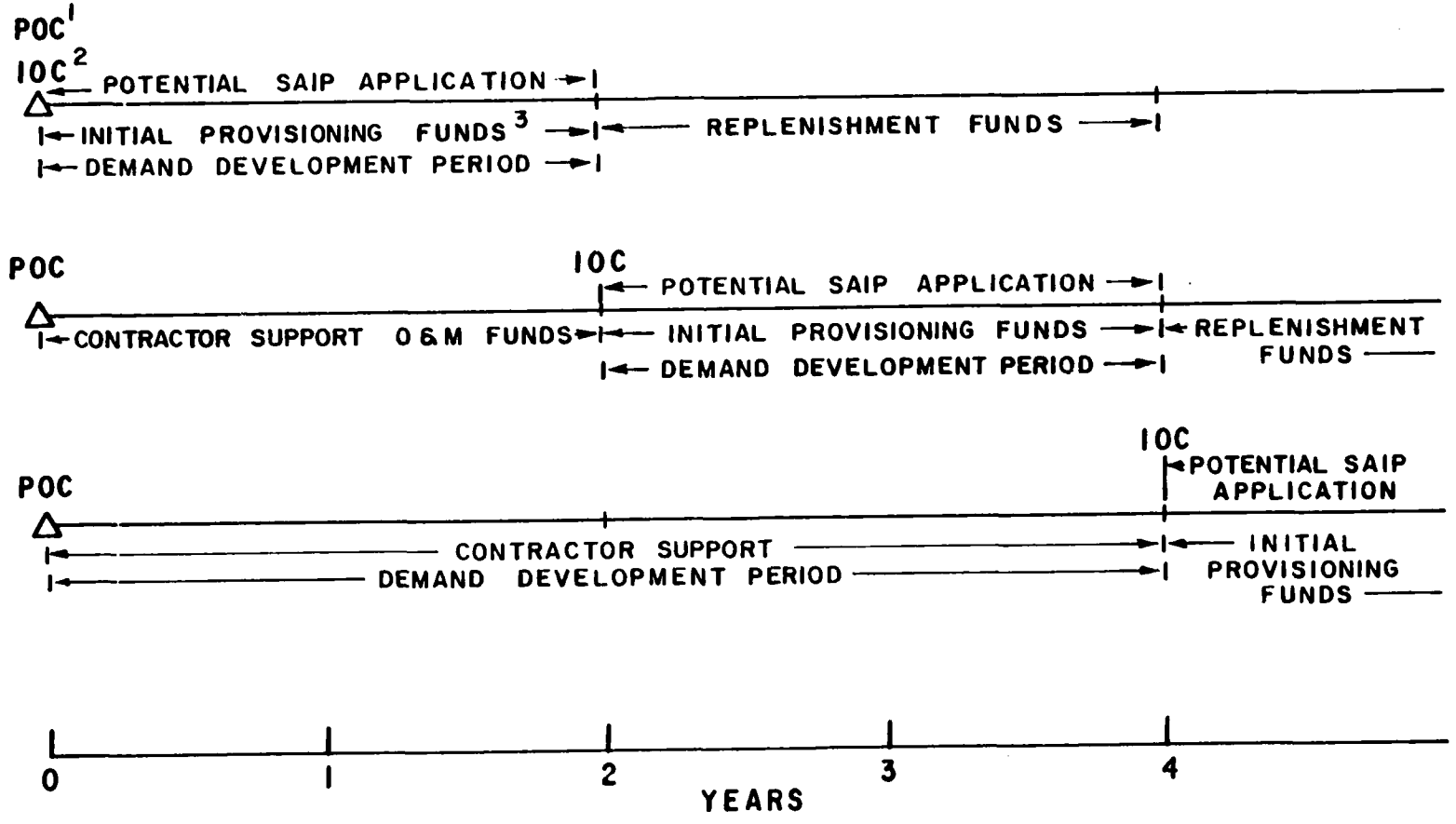
Current DoD provisioning policies require that spare and repair parts be ordered procurement leadtime (PLT) away from the support item's need date, and in minimal quantities. These policies are intended to minimize the risk of overprocurement because of inaccurate forecasts of demand, and the risk of procuring spares that will soon become obsolete and require modification, retrofit or disposal. This conservatism is the rule but some exceptions that are allowed are described in Chapter 5.

We should mention here, as far as buying early is concerned, that a SAIP application under each of the three illustrated alternative initial provisioning strategies would involve a different degree of risk. The nature of the risk associated with alternative one would be greater than for alternative two, and there would be perhaps more risk with alternative two than with alternative three.

SCOPE

When SAIP was developed as an alternative spares procurement and management technique by the Air Force in 1974, it was proven that a number of the

FIGURE 1-1. THREE ALTERNATIVE SUPPORT STRATEGIES AND THEIR SAIP APPLICATIONS



NOTES: 1. POC = PRELIMINARY OPERATIONAL CAPABILITY

2. IOC = INITIAL OPERATIONAL CAPABILITY

3. = THE FUNDS CITED HERE ILLUSTRATE HOW SUPPORT ITEMS MIGHT BE FUNDED FOR THE SPECIFIED PERIODS.

major components on the F-15 could be procured more cheaply if their orders were combined with those of the production installation items. The Air Force published Air Force Regulation (AFR) 800-26, "Spares Acquisition Integrated with Production" (SAIP), 17 February 1978, requiring the application of SAIP to all major new production and modification programs.

In 1980, the Navy attempted to use SAIP to procure F/A-18 spares but was thwarted by DoD policies that discourage the obligation of spares funds for unapproved programs. This prompted the GAO to recommend that DoD re-evaluate its spares procurement policies inhibiting the use of SAIP. GAO also recommended that spare part procurements be treated in the same manner as advance procurement for long-leadtime production items. GAO cited potential Navy F/A-18 savings of $160 million, based on documented F-15 savings of 15 percent. However, our discussion of SAIP centers on the Air Force applications of SAIP to its major weapon-system acquisitions: the F-15 and F-16 aircraft.

We have reviewed audit reports and other studies pertaining to SAIP applications and present those findings as well as our own, but in no way does this report constitute an audit of SAIP acquisitions. We have collected records from contractors and Government personnel for the F-15 and F-16 programs only. We did not attempt to validate the data. Little has been written about the F-16 SAIP experience; therefore, the F-16 data presented appear for the first time here.

The nature of past SAIP procurements does not allow a complete study of SAIP cost-effectiveness. Instead this report provides a comprehensive review of both the policy issues and implications of using SAIP. We also discuss the theory behind SAIP and the reasons why, when certain conditions are met, SAIP makes good business sense.

2. REVIEW OF APPLICATIONS

INTRODUCTION

The Air Force philosophy behind concurrent spare and production installation items procurement is set forth in a 1978 Air Force Regulation--AFR 800-26, "Spares Acquisition Integrated with Production (SAIP)." The Air Force is the only DoD component to make concurrent ordering a formal spares procurement technique. However, the Air Force is not the only DoD component to apply the SAIP concept. In this chapter we first explore the circumstances attending the emergence of concurrent ordering and then describe some approaches to this concept.

Scope of Review

Our review of the applications will be centered upon Air Force experience--in particular with reference to the F-16. There are several reasons for this, the foremost being that the Air Force is credited with having originated the concept. Other related factors are: (1) the F-16 was the first weapon system for which SAIP was applied methodically, (2) the F-16 SAIP procedure embodied many of the provisions of AFR 800-26, (3) many lessons can be learned from the F-16 experience, (4) not much has been written on the F-16 experience with SAIP, and (5) there have been no assertions of savings from having used SAIP on the F-16 program. We explore the reasons that no such assertions have been made and compare the F-16 with the F-15 SAIP applications about which more has been published. Before discussing the F-15 and F-16 applications, we provide some background for that discussion to provide the reader with some sense of the context in which SAIP was implemented on these two programs.

BACKGROUND

Market conditions have led to increasing and uncertain leadtimes for many items and have dictated concurrent ordering of spares and production installation items in a number of programs. This is reflected somewhat in increased advance procurement budgets, but the true magnitude of the advance procurement requirements may still be hidden because prime contractors are, in some instances, ordering spares for the Government before the Government funds for spares have even been appropriated. The prime contractor may be motivated to place selected spares on order prior to his receiving Government orders if (1) he perceives that the Government order may not arrive in time to support the end items, (2) he is reasonably sure that the Government will want to buy the items he selects, (3) he has negotiated reasonable termination liability clauses with his suppliers in the event that the Government order is not forthcoming, (4) he is certain that the Government plans to order the spares through him, and finally (5) he feels a commitment to support his products. The willingness of the prime contractor to reserve a place in the queue for the Government, so to speak, in advance of receiving a contract or purchase order for spares is, of course, not the general order of business. A contractor's decision to undertake such risks is dependent upon both his dedication to support the end item, and his knowledge and understanding of Government procurement actions.

Expanding Leadtimes

An illustration of expanding leadtimes in Figure 2-1 shows leadtimes of items on selected weapon systems for 1977 and 1980. Compare this with the current leadtime the Navy faces for its radar system today--more than 42 months. In the initial years of the program, expanding leadtimes would appear to be a greater problem for spares support than for production installation

FIGURE 2-1. EXAMPLES OF INCREASED LEADTIMES FOR VARIOUS SYSTEMS AND PROGRAMS

SYSTEM	1977 (MONTHS)	1980 (MONTHS)	DRIVERS
F-15	36	41	LANDING GEAR
F-16	28	42	SERVO ACTUATORS
A-10	29	49	LANDING GEAR
F100 ENGINE	19	37	FORGINGS
TF34 ENGINE	20	39	FORGINGS

SOURCE: DEFENSE SCIENCE BOARD 1980 SUMMER STUDY ON INDUSTRIAL RESPONSIVENESS

OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING, JANUARY 1981.

items, since it is generally believed that advance procurement funding can be requested for installed items but not for spare parts. For example, a 1978 Naval Audit Service Report [13] found that:

a. NAVAIR has been unable to obtain approval to budget advance procurement funds for certain long-leadtime aircraft component spares, even though this apparently would benefit the Navy by reducing costs of spares to the F/A-18 aircraft project and by assuring delivery in time to meet OPEVAL and operational support requirements.

b. DOD Directive 7200.4, Full Funding of DOD Procurement Programs, states that each annual appropriation request must contain the funds estimated to be required to cover the total cost to be incurred in completing delivery of a given quantity of usable end items. In implementing this directive, NAVCOMPT requires full funding of a fiscal year program with the exception of long-leadtime component procurement. This procurement is limited to components whose leadtimes are significantly longer than other components of the same end item. NAVCOMPT does not consider spares in this category and does not qualify them for advance procurement funds.

In a Navy Aviation Supply Office (ASO) 1979 point paper on SAIP [16;3] it was stated:

> DoD Instruction 7200.4 precludes the obligation of spares funds (APN-6) for a "non-approved" aircraft program. In light of the substantial leadtimes and the requirement to assure vendor capacity early, this requirement appears obsolete. Moreover, current DoD policy allows early commitment for the aircraft itself; thus it would appear to be somewhat illogical to permit substantial dollar commitments for aircraft in a non-approved program and yet to simultaneously disallow far smaller "termination liability" contracts for the spares.

The 1979 GAO report echoed this sentiment [8]. In response to the GAO report DoD stated that the restriction in DoDD 7200.4 did not prevent the services from requesting full funding for long-leadtime spares. Yet, long-leadtime funding for spares appears to be the exception and not the rule.

We may therefore find contractors receiving authorization to procure long-leadtime production installation items yet having no authority to release purchase orders for long-leadtime spares, as was the case with the F/A-18. Some contractors may decide to accept some risk and to submit an order for

spares with their suppliers in order to ensure that the spares will be delivered on time. The contractor can choose to order the spares either along with his production installation items, as with SAIP, or simply PLT away from the materiel need date. Without the actual spares contract in hand, this decision would depend on the individual contractor's acceptance of risk.

Thus, under some circumstances, the Government may reap the SAIP benefit of assuring on-time delivery of spares without actually having a SAIP contract. This observation, though, would appear to be limited in scope since it is based on the individual contractor's responsiveness and degree of initiative in taking extraordinary measures to support the weapon system.

Low Priority of Small Government Order Quantities

Another marketplace reality today is that defense contracts make up a small percentage of the workload for many suppliers. The defense contract for a minimal order of spares becomes somewhat insignificant when compared to that of the prime contractors (compare buying one of an item for each of 150 aircraft to buying five or even fifteen spares of the same item). The Government order may be even less significant to firms that do the bulk of their work for commercial customers. Expanding leadtimes, combined with the relative scarcity of some essential raw materials (e.g., cobalt and titanium) and the relatively small size of Government spares orders may result in a low priority being placed on meeting the terms of the defense spares contract in a timely fashion.

Protection of Delivery Schedules. A low priority may result in schedule slippages and even longer leadtimes. The prime contractor, who buys in large quantities, can exercise more clout when it comes to assuring on-time deliveries of items and adherence to contractual terms. Thus, SAIP is a means by which the Government may have its spares orders on a par with orders for

production installation items as far as the supplier's work effort and performance are concerned.

F-15 SAIP EXPERIENCE

SAIP was originally conceived by the McDonnell Aircraft Company (McAir) as a method of improving the acquisition process of spare parts. McAir called the concept the Spares Acquisition Improvement Program or SAIP. This concept was presented to the Air Force for application to the F-15 program; thus, the prime contractor was the motivating force behind the first SAIP application.

Resource Conservation

The concurrent ordering of spares and installs was authorized for the F-15 under the USAF Resource Conservation (RECON) Program. Under this program the F-15 system manager was able to deviate from established initial provisioning procedures in several respects: (1) for some procurements entire shipsets were purchased under the prime contractor's vendor options; (2) the F-15 system manager (SM) continued procuring spare parts long after the transition to the item managers (IMs) would normally have occurred; and, (3) some items were purchased from the prime contractor long after breakout from the prime would normally have taken place. The F-15 managers were able to justify these exceptions to normal provisioning by showing that savings, the conservation of resources, resulted. Once savings were shown for a particular provisioning technique, the SM could continue purchasing under the technique without further justification of savings to HQ USAF until it was shown to be no longer economical.

There were three techniques employed under the RECON program. The first was called option procurement or vendor options and involved the purchase by item managers of entire shipsets as spares rather than the purchase of the individual components. The second was the procurement by the F-15 SM

of shipsets as replenishment spares rather than passing the procurement responsibility on to the item managers. The third technique involved the use of the SM as the central manager for the procurement of replenishment spare components (not entire shipsets) rather than having the item managers procure the items. The three techniques were shown to be cost-effective in separate RECON Individual Savings Action Reports when each was first introduced [17]. Each technique could then be continually employed until the unique situation that created the savings disappeared.

Vendor Options--Initial Provisioning

The first concurrent order for spares and installs was placed by the F-15 SM for eight complete radar systems. The radar purchases were made possible by McAir's procurement of extra production installation radar sets which it passed on to the Government as spares. By buying whole systems, rather than the required LRUs and SRUs upon which the spares computation is based, the Air Force in effect overprocured some line items. The cost savings, appearing in Table 2-1, were felt by Air Force auditors at the time to justify the acquisition of these items that were temporarily in long supply. The savings given in Table 2-1, $8.07 million, are quite impressive and originate, we presume, both from economies of scale and the competitive prices negotiated by McAir during its supplier selection period. Yet these same savings were called into question in a 1979 Defense Audit Service report [2].

The DAS reviewed two of the thirty items listed in Table 2-1 and concluded that the Air Force overestimated the amount of the savings. The DAS looked at the prices negotiated for the two items in 1974 (see Table 2-2). The DAS questioned whether the contractor's estimates of vendor prices should be used to compute SAIP savings, and whether the radar components might have been purchased more cheaply as pieceparts, not as part of a complete radar system.

TABLE 2-1. F-15 RADAR PRICES AVAILABLE TO THE GOVERNMENT MAY 1973

Noun	AFLCR 57-27 Reqmt	Estimated Unit Price	Qty Bought	Total $ If Bought at DATS Price	Qty Over-Bought	$ Over-Bought
Wave Guide	9	$ 423	8	$ 3,384	0	$ 0
Wave Guide	1	423	8	3,384	7	2,961
Wave Guide	9	423	8	3,384	0	0
Wave Guide	9	423	8	3,384	0	0
Wave Guide	1	254	8	2,032	7	1,778
Wave Guide	9	254	8	2,032	0	0
Oscillator	16	182,958	8	1,463,664	0	0
Wave Guide	1	1,300	8	10,400	7	9,100
Transmitter	16	225,607	8	1,804,856	0	0
Receiver	8	166,669	8	1,333,352	0	0
Divider	21	1,269	8	10,152	0	0
Antenna	19	301,846	8	2,414,768	0	0
Processor	13	198,411	8	1,587,288	0	0
Processor	29	315,627	8	2,525,016	0	0
Processor	19	294,900	8	2,359,200	0	0
Control	8	11,000	8	88,000	0	0
Power Supply	11	109,633	8	877,064	0	0
Antenna	1	790	8	6,320	7	5,530
Antenna	1	750	8	6,000	7	5,250
Divider	1	50	8	400	7	350
Antenna	1	1,258	8	10,064	7	8,806
Antenna	1	1,258	8	10,064	7	8,806
Divider	1	1,626	8	13,008	7	11,382
Divider	1	1,626	8	13,008	7	11,382
Wave Guide	11	535	8	4,280	0	0
Wave Guide	9	439	8	3,512	0	0
Wave Guide	9	561	8	4,488	0	0
Wave Guide	9	513	8	4,104	0	0
Gasket	1	1,338	8	10,704	7	9,366
Horn	1	1,144	8	9,152	7	8,008
Total Cost Per (1 Sys) Normal Provisioning Procedures		$1,823,308	(8 Sys)	$14,586,464		$ 82,719 Amt. Over-Bought
Cost of 1 System on McAir's Option		$ 803,800				
Estimated Savings Per System		$1,019,508				
Estimated Savings for 8 Systems		$8,156,064				

Net savings for 8 systems = gross savings minus amount overbought
= $8,156,064 - $82,719 = $8,073,345

Note: The two subsystems reviewed by the Defense Audit Service are boxed above.

TABLE 2-2. DEFENSE AUDIT SERVICE REVIEW OF TWO F-15 RADAR COMPONENTS

Component	Unit Price			Overstatement of Savings (8 Systems)
	Estimate*	Actual**	Difference	
Oscillator	$182,958	$ 48,399	$134,559	$1,076,472
Transmitter	225,607	153,696	71,911	575,288
Total			$206,470	$1,651,760

*Estimate in 1973.
**GAO price cited for 1974.

What we found on a visit to the F-15 system manager was that the radar was purchased as a complete unit, for spares purposes, in both FY74 and FY75. The price estimates the Air Force faced at the time of the FY75 buy are presented in Table 2-3. Once again, concurrent ordering of spare parts and installs resulted in tremendous estimated savings, 37.6 percent, and also in the temporary overstocking of some items.

The basic question DAS raises about the use of the contractor's estimates to compute savings is valid. Yet, one must bear in mind that the estimates of prices yield only an estimate of savings--not actual savings--and are, at the time of the initiation of the procurement order, the best estimates available. One must also remember that the Priced Spare Parts List (PSPL) prices are used as a basis for subsequent negotiation of firm prices. The low firm prices DAS cites were, perhaps, made possible by the combined order of spares and production installation items. The larger lot sizes allowed the producers to descend their learning curves faster or at least prevented them from pricing spares based on smaller, intermittent orders.

In any event, it would appear that the impressive estimated savings appearing in Table 2-3 would carry over in some fashion when firm prices were

TABLE 2-3. F-15 RADAR PRICES AVAILABLE TO THE GOVERNMENT 1974

Noun	Computed Requirement	Estimated Unit Price	Qty Bought	Total $ If Bought at DATS Price	Qty Over-Bought	$ Over-Bought
Wave Guide	0	$ 1,176	22	$ 25,872	22	$ 25,872
Wave Guide	0	1,147	22	25,234	22	25,234
Wave Guide	0	254	22	5,588	22	5,588
Wave Guide	0	665	22	14,630	22	14,630
Wave Guide	0	491	22	10,802	22	10,802
Wave Guide	0	584	22	12,848	22	12,848
Oscillator	14	122,751	22	2,700,522	8	982,008
Wave Guide	0	630	22	13,860	22	13,860
Transmitter	22	279,846	22	6,156,612	0	0
Receiver	4	187,642	22	4,128,124	18	3,377,556
Divider	0	618	22	13,596	22	13,596
Antenna	19	301,846	22	6,640,612	3	905,538
Processor	22	274,866	22	6,047,052	0	0
Processor	45	315,627	45	14,203,215	0	0
Processor	21	198,411	22	4,365,042	1	198,411
Control	2	9,282	22	204,204	20	185,640
Power Supply	4	109,633	22	2,411,926	18	1,973,394
Antenna	0	1,660	22	36,520	22	36,520
Antenna	0	1,705	22	37,510	22	37,510
Antenna	0	1,258	22	27,676	22	27,676
Antenna	0	1,258	22	27,676	22	27,676
Divider	0	1,626	22	35,772	22	35,772
Divider	0	1,626	22	35,772	22	35,772
Wave Guide	0	485	22	10,670	22	10,670
Wave Guide	0	412	22	9,064	22	9,064
Wave Guide	0	393	22	8,646	22	8,646
Wave Guide	0	521	22	11,462	22	11,462
Wave Guide	0	417	22	9,174	22	9,174
Gasket	0	86	22	1,892	22	1,892
Horn	0	2,133	22	46,926	22	46,926
Total Cost Per Normal Provisioning Procedures		$39,243 762		$47,278,499		$8,043,737
Cost of 22 Systems on McAir's Option		24,943,021		Net savings for 22 Systems (Gross savings minus amount overbought)		
Estimated Savings $14,300,741				$14,300,741 - $8,043,737 = $6,248,004		

Note: Price of 1 System per normal provisioning (1 of each part) $1,819,049
Price of 1 System under McAir's Option 1,133,774
Gross Savings per system of 37.6% or $ 685,275

subsequently negotiated. Unfortunately, this presumption cannot be verified since the spares and installs were not subsequently negotiated both separately and alone.

Vendor Options--Replenishment

The above section discussed the F-15 experience with vendor options for the FY74 initial spares buy. The FY75 buy was for replenishment spares and therefore required a separate RECON Individual Savings Action Report. The vendor options for replenishment spares presented the Air Force with two "firsts". It was the first time that replenishment spares were procured by the SM rather than the item managers (IMs). It was also the first time that replenishment spare parts were procured at the shipset level, rather than the LRU and SRU level. Another difference was that with concurrent ordering, the spares were placed on order once during the fiscal year, as opposed to at least twice by the IMs.

There were 26 systems selected by McAir as concurrent ordering candidates. For these systems, McAir had quantity variation clauses for production items that it was allowing the Government to purchase as spares. The savings were estimated at the time to be 36 percent, with the radar unit comprising 85 percent of the total dollars for the 26 systems. The savings were once again computed by comparing the data accumulation/transmittal sheets (DATS) estimates of unit prices for the items' computed requirements, with the option prices of 26 whole systems.

There was a deliberate overbuy of those systems for which no requirement existed and for which the computed requirements were less than the amount of the item contained in the shipsets purchased. Tables 2-1 and 2-3 illustrate both the quantity and estimate of dollar value of those items that were overbought on the two radar purchases. The Air Force later termed the

dollar amount of the overbuy "subsequent savings", since it was felt that the long supply quantities were being procured at greatly deflated prices, which would reduce subsequent procurements of replenishment spares. For the 26-item purchase, the subsequent savings represented 34 percent of the estimated value of the production option quantities that were being purchased.

Piecepart Replenishment Spares Procurement

The third variation of SAIP employed on the F-15 program was the variation we described in Chapter 1. The F-15 system manager aggregated spares requirements from the IMs and submitted them on a single purchase order to McAir. By doing this, the Air Force computed savings of $39 million, based on the price estimates available in FY76. Additionally, by combining spares and production installation items it was estimated that the Government would save $19 million more on the production aircraft. This was based on McAir's renegotiating with its vendors for the combined production of spares and production installation items.

Impact of F-15 SAIP on Conventional Provisioning

The F-15 example illustrated the impact that SAIP can have on the Service's normal way of provisioning for spare parts. SAIP affected not just the quantity on order (for the vendor option) but also the timing of the purchases and the purchasing responsibility.

Impact on Quantities. For the vendor-options variation of SAIP the Air Force essentially procured long supply items: items for which no current requirements exist but, in this case, for which it was reasonable to expect there would be future requirements. In all cases it was cheaper for the Air Force to purchase the vendor option shipsets than to procure the LRU and SRU items for which computed requirements existed. For the third F-15 SAIP variation, orders were placed for the computed quantities of spare parts.

Impact on Provisioning Responsibilities. Established Air Force procedure requires that the responsibility for procuring replenishment spares falls on the individual item managers. The item managers are located at the various air logistic centers (ALCs), each ALC having responsibility for specific aircraft systems. The item managers use the recoverable consumption requirements system (D041), a computerized spares replenishment model, to calculate their spares requirements. The spares are then purchased, PLT away from need date, on either a quarterly, semi-annual, or as-needed basis. SAIP affected this procedure by the requirement that orders be placed annually and by the SM--not the IMs. The spares order was subsequently managed by the prime contractor, who was under contract to ensure timely deliveries of properly configured items. The net result was that fewer orders were placed and these were managed centrally, thus reducing the Government's administrative burden.

Pricing F-15 SAIP Items

It was earlier stated that McAir was able to pass on to the Government its vendor option quantities at prices that were negotiated in 1969, three years prior to the first concurrent purchase. This statement is not entirely accurate, although it does impart the point that the contractor's prices for production items were passed on to the Government. What makes the statement inaccurate is that the prime contractor's prices were not the prices that the Government was expected to pay. To the vendor option price there was added an overhead fee, in the range of 12 to 15 percent. To this new price there was added a surcharge intended to take care of any (non-major) configuration modifications that occurred after the ordering of an item but before its introduction into the Air Force inventory. Class I changes, those

major changes affecting an item's form, fit, or function, were subject to renegotiation.

SAIP Management Fee. Spares purchased through the prime contractor as CFS are generally assessed a surcharge: overhead, general and administrative charges, and/or profit. These fees are what the Government seeks to avoid in its spares breakout program, yet they are unavoidable during the initial support years when other logistics and configuration control risks are great. McAir's practice with SAIP on the F-15 was to add a profit charge to all orders, and to add both profit and a management fee to those items for which it expended additional labor hours. Since most of the SAIP items were shipped directly from the vendors, the profit-only charge was the predominant one.

Contingency Charges for Changes. The surcharge that McAir applied to all vendor option items to cover configuration changes was approximately two percent. The application of this factor can be viewed as an attempt to eliminate the costly administrative burden that can result from design change notices (DCNs) and engineering change proposals (ECPs). Not all DCNs or ECPs result in price increases when implemented; some may result in price decreases. The two percent can be viewed as an estimate of what, on the average, it costs to implement configuration changes. Thus, the two percent can be viewed as a contingency charge: a charge meant to cover possible costs, not costs that have been experienced. The two percent, though it may seem infinitely reasonable to seasoned engineers and contracting personnel familiar with the introduction of highly complex end items, did not come about as a result of statistical analyses, and was, in fact, arbitrary. However, McAir ran into difficulties with the contingency charge. They attributed the difficulty to the Government's Cost Accounting Standards (CAS). We have found

that both CAS and Defense Acquisition Regulation clauses state that the Government pays for actual costs, not contingencies. Thus, since the contingency charge was not based on actual costs, or even estimates of actual costs that the contractor might incur, the charge was discontinued. Fortunately, perhaps, the charge was discontinued after many of the designs had been stabilized, that is, after the inherently unstable initial provisioning period. The F-16 could surely have benefited from having such an arrangement; in fact, the F-16 AFPRO personnel espouse the notion of "once-priced/always-priced" in the aftermath of the F-16 experiences with undefinitized prices.

F-16 SAIP EXPERIENCE

The F-16 program was the first major weapon-system program to require the use of SAIP. This alone presented problems since, by the time the SAIP requirement came along, the production contract had already been awarded. Thus, SAIP became part of the separate spares contract and was linked to the production contract by various clauses and amendments, which presented immediate problems to the F-16 prime contractor, General Dynamics (GD). The primary problem was the fact that GD had already lined up its vendors and suppliers, all of whom had contracts which did not include SAIP, per se, and this led to the rejection by some contractors of the SAIP concept.

F-16 SAIP Selection Criteria

The F-16 had written item selection criteria that involved (1) all recoverable items cost-ranked down through 90.02 percent of total cost (based on unit price times expected order quantity), (2) items with a unit price in excess of $5,000, (3) all items not included above with leadtimes of 13 months or more, and (4) other selected high-usage items. GFE items were excluded. This screening resulted in the review of 248 items of which 105 were recommended for SAIP, 112 were recommended for later procurement, and 31 were

recommended for phased provisioning. The F-16 SAIP application was confounded by the fact that GD had already negotiated three years' worth of production items with its suppliers at a fixed price. An effort was therefore made to implement SAIP with those manufacturers with whom GD had negotiated quantity variation clauses allowing the purchase of ± 50 percent of production requirements. The 105 items mentioned above were from these manufacturers. This resulted in the purchase of items identical to those GD had on its purchase orders with its suppliers.

Rejection of SAIP by Subcontractors

Ten out of 30 of the F-16 subcontractors producing items that were candidates for SAIP declined to participate. It is generally felt that these ten firms declined because SAIP was not introduced to them early enough, that is, when they were negotiating for production items with the prime contractor, GD. The Government did not have SAIP on the production contract and therefore felt that SAIP spares could be purchased from the ±50 percent production option GD had with its suppliers. Thus the Government requested that GD advise the subcontractors that "for the already negotiated FY77-78-79 buys, the Government reserves the right ... to procure all or any part of the variation in quantity of production installs as spares at the pricing formula currently on contract." [10] Additionally, in a letter from GD to its suppliers, it was requested "that any SAIP quantities in excess of the 50 percent be supplied at a price no greater than that presently established in the production options." Thus, the Air Force sought to implement SAIP on the F-16 through the exercise of GD's quantity variation clauses and some contractual language linking the SAIP clauses (contained in a separate spares contract) and the already negotiated production contracts.

Responses of the subcontractors to GD's letter ranged from full acceptance of both conditions, to acceptance of the Government's proposal alone, to rejection of both. The reasons for the rejection provide some insight into the subcontractors' understanding of the F-16 SAIP program. The subcontractors not wishing to participate in SAIP used one or more of the following reasons:

- spares prices are computed differently from those for production installation items;
- the market conditions upon which prices for production installation items were based had changed considerably since the production options were negotiated;
- prices for production installation items are traditionally substantially below normal selling prices as they are developed competitively and they are directly influenced by potential spares sales which are offered at full selling prices, including a nominal profit;
- spares prices are based on actual cost visibility at the time the order is placed; and
- offering spares at the same prices as production installation items increases the inherent risk, exposure to which for such a long period of time might prove not to be in the firm's best interests.

These reasons, taken as a whole, suggest that there was present some degree of "buy-in"--that phenomenon whereby the production installation items are sold at a loss or at substantially reduced prices, in the hope of getting into the program and then selling spares as a sole-source agent, usually at much higher prices. There is also a prevalent belief that spares pricing is justifiably inconsistent with the pricing of production items, the former a function of the degree of competition present, and the latter dependent upon actual costs, profit rates, and, perhaps, "getting well." An important benefit of a proper SAIP application might be fair and reasonable prices for both spares and production installation items from the very beginning; i.e., the "buy-in" phenomenon could disappear.

General Dynamics personnel expressed to us their misgivings over the Air Force requirement that the negotiated price for production installation items also carry over to the spares. GD's reasoning was that shipsets were bought for installation, not line replaceable units (LRUs) and shop replaceable units (SRUs), and, therefore, identical pricing was impossible. This signifies the problems that may be encountered when one contractor's modus operandi is thrust upon another contractor. McAir, it appears, encountered no difficulty in adding LRU and SRU purchases to its production requirements whereas GD's contracts with its vendors stipulated that the spares were to come out of their quantity variation clauses, which were for shipsets, not individual components.

The Air Force, realizing that there were perhaps legal grounds for not applying SAIP to components, later advised GD of its intention to proceed with SAIP for shipset or LRU level spares, i.e., for those items required that were identical to items GD had in its purchase order. The entire SAIP application on the F-16 was limited to those items for which GD had negotiated quantity variation clauses.

Guidance From Air Force

The F-16 application of SAIP occurred prior to the publication of AFR 800-26; thus, there were no formal AFLC guidelines. The only other SAIP application had been the F-15, the program on which AFLC modeled its F-16 application. Unfortunately, however, the F-16 program had a separate spares contract that was not authorized until 18 months after the production contract was signed. Thus, General Dynamics had already developed pricing, production, and delivery arrangements with its suppliers when advised that the F-16 SPO intended to exercise its right to procure all or part of the variation of production installation items as spares at the pricing formula GD then had on

contract with its suppliers. The GD vendor option contract was based on a 998 aircraft (A/C) buy covering five fiscal years. The result of this edict was discussed above. What we discuss here is the general guidance received by the F-16 SPO from AFLC as indicated in correspondence at the time.

It was mentioned above that many of GD's suppliers rejected the SAIP concept and that the Air Force was forced to try to use the quantity variation clauses that GD had negotiated in its 998 aircraft shipset contract. When many of the shipset vendors balked at this idea, the AF Aeronautical Systems Division's (ASD) response was:

> 1. Our review of ... subcontracts (Purchase Orders) has failed to reveal any legal reason that would preclude General Dynamics from ordering spares at install prices against the variation in quantity clause contained in your subcontracts, providing the order is at the shipset or LRU level contained in the GD Purchase Order.
>
> 2. You are therefore advised that the Government, with the possible exception of the subcontract with Goodyear, will initiate spares orders concurrently with end items with General Dynamics and that the Air Force expects General Dynamics can [sic] place such orders with their vendors against the variation in quantity clause contained in the subcontracts. This procedure will enable the Air Force to procure spares at the same price as identical end items under the prime airframe contract. While this method does not follow the full intent of SAIP, as previously discussed on numerous occasions with General Dynamics, it appears that this is the only workable alternative available at this time.
>
> 3. Therefore, the Air Force, unless advised by General Dynamics of some legal prohibition to the contrary, is initiating its planning on this basis. [15]

The tenor of this quote is representative of that found in much of the early correspondence between the Air Force (both AFSC and AFLC) and General Dynamics.

It is instructive to review what it is the Air Force was attempting to do. The Air Force sought to exercise production options as spares at the prices arrived at (some through competition) several years earlier by GD. The

prices had been negotiated on a firm fixed price or fixed price incentive basis.

The AF intent, as communicated by ASD, was to procure spares at the same prices as the identical production installation items. We might take this to mean to fund spares initially at a level consistent with or, if you please, identical to the identical production installation items. We make this distinction because, after the order for spares was placed, any changes to the item (via DCNs or ECPs) would not, generally, impact the price of the spare and the production installation item to the same degree. And without any changes to the item at all, the eventual price of the spare would have been different from the price which the Government could expect to pay for the production installation item -- even with identical pricing. There are several reasons for this:

1. Negotiation and definitization of the spares prices were performed separately from those for production installation option prices.

2. Spares prices included profit and management fees and spares-peculiar costs over and above the negotiated option prices.

3. Production items are not quoted at the part number level, but spares are; thus there was no visibility of spares and production installation item prices.

4. Procurement responsibility for spares and production installation items is designated to separate offices within the Air Force. To our knowledge, there was no designated office of primary responsibility to ensure consistency and comparability of prices for the F-16.

The final point (4) is especially important and is inextricably tied to points (1) and (3) above it; yet the visibility and consistency of the spares and production installation item prices would appear to be a vital element in a successful SAIP application.

F-16 Ordering Experience

There were six USAF F-16 SAIP options, but only four were exercised: three during the initial provisioning period and one during the replenishment period. The timing of these SAIP orders appears in Figure 2-2. The initial provisioning period lasted for two fiscal years - 1977 and 1978. The total number of aircraft to be supported in this period was 150.

As the figure shows, considerable time elapsed between the first and last spares procurements. There is no evidence to suggest that estimates of item characteristics were changed during that time. (By item characteristics we mean failure rates, condemnation rates, repair levels and other inputs to spares calculation formulae.) The process by which these estimates were assigned for the F-16, as well as the tendency of the Air Force not to change initial provisioning factors once decided upon, suggests that the quantities bought would not have been different.

SAIP procurements are generally made in advance of implicit PLT ordering dates. The degree to which the SAIP and PLT dates differ would seem to indicate the additional period of time during which changes could possibly occur in the provisioning factors (e.g., maintenance factor, condemnation rate, unit cost, etc.) that are used to determine the spares requirements.

Staggering order dates to coincide with the prime contractor's order dates would therefore tend to minimize the period of time between SAIP order dates and conventional PLT-away order dates, while accruing to the Government the benefits of SAIP.

This staggering of SAIP order dates did not occur for the first four SAIP options on the F-16. The ordering dates for F-16 SAIP items occurred an average of 21.5 months prior to the procurement-leadtime-away ordering dates for the first F-16 SAIP option. Table 2-3 shows the averages for the four

FIGURE 2-2. USAF F-16 SAIP ACTIONS

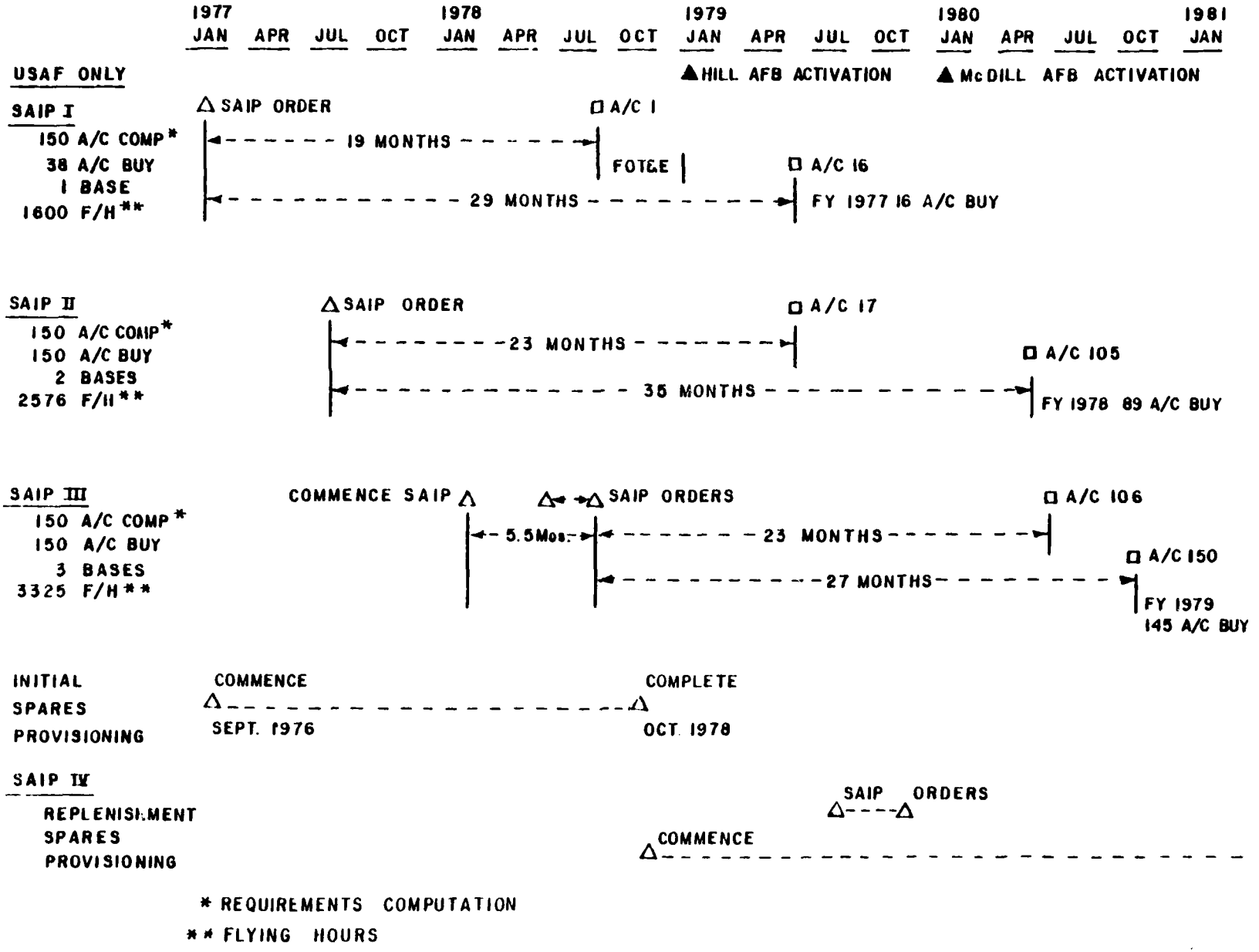


TABLE 2-4. AVERAGE LEADTIMES AND TIME ON ORDER FOR FOUR F-16 SAIP OPTIONS

	Time on Order	Lead Time
SAIP I	21.50	12.6 mos
SAIP II	24.59	12.8 mos
SAIP III	18.97	12.8 mos
SAIP IV	20.32	17.8 mos
NON-SAIP	11.00	17.8 mos

annual SAIP options. The difference between PLT and ordering dates was the direct result of having annual ordering dates and may be considered a "worst case" example for SAIP. We say that this is a worst case example because using one annual order date for all SAIP items does not have to be the case; for the most part, prime contractors do not place orders with all their manufacturers on one date.

The annual ordering employed on the F-16 SAIP program did cause spares calculations to be performed prior to when they normally would have been performed for the first SAIP option. As a result, the first SAIP requirements computations were performed prior to the completion of the formal process called ORLA/DORR[1] during which provisioning factors and SMR codes are assigned. The first SAIP requirements for the F-16 were computed manually based on AFLC Regulation (AFLCR) 57-27, the implementing Air Force directive for DoDI 4140.42. We are not, at this time, cognizant of how the manually computed quantities for the first F-16 SAIP items differed from what they might have been had the provisioning been done using MOD-METRIC. Had we been able to recover the early SAIP initial provisioning factors used, and we were not, it is not clear that a replication of the AFLCR 57-27 computation would

[1]ORLA/DORR stands for Optimum Repair Level Analysis Depth of Repair Report. The ORLA/DORR process fulfilled the F-16's Logistics Support Analysis (LSA) requirements.

have resulted in the same shopping list of items that were bought by the F-16 System Manager (SM). AFLCR 57-27 is merely a guide to determining requirements; adjustments to computed quantities, especially for new programs, would not be unusual.

No comparison can be made of the SAIP pre-ORLA/DORR provisioning factors and those that were agreed on later. For the subsequent SAIP buys, one thing that is clear is that the quantity bought with early ordering dates would not have been different from the quantity if one had waited until PLT away. For the F-16, the provisioning factors agreed to during the ORLA/DORR process remained unchanged, for the most part, during the initial provisioning period. The provisioning factors agreed to during the ORLA/DORR process were not generally updated to reflect the available test and/or field data. There was a decision made to live with the initial provisioning factors during the demand development period (the first two years) until replenishment activity occurred.

We therefore conclude that the F-16 practice of annual SAIP order dates may have caused a different quantity of spares to have been bought for the first SAIP buy, but subsequent SAIP buys should not have resulted in different order quantities. We are not certain about the degree of over- or under-procurement that might have resulted from the first F-16 SAIP buy.

F-16 Configuration Management

The F-16 spares contract included a clause requiring that delivered spares have the same configuration as the associated installed part. The Air Force has included a similar clause in each weapon system contract since it was first introduced on the F-16 spares contract. The contract gave authority to the manufacturer in the event of a configuration change to determine the appropriate numbers of old and new parts on a pro-rata basis and then to

submit the associated price impact for the spare, that is to submit a unit price for the new configuration (dash number).

The normal procedure is for the vendor to have on order, say, part X-1. A design change occurring to the item may result in a new part number, say X-3; yet the vendor would have on contract an order for part X-1. Thus the installed part may be an X-3, while the delivered spare would be in the old X-1 configuration. The vendor had no authority to deliver the new part since that would require a new purchase order requesting the new dash number. SAIP, through linking the production order with the spares order, and through automatic proration clauses, would reduce the risk of having non-current and possibly obsolete material delivered.

The contract also contained language requiring the contractor to prorate old and new parts in a proper ratio so as to be able to support already-delivered end items. This was in the event that design changes occurred after the delivery of partial quantities of end items.

Pricing of SAIP Spares

The purchase of the F-16 SAIP items was made possible by the exercise of General Dynamic's quantity variation clauses for production items. This clause applied to GD's shipset program only. The prices for the options were based on the production quantities that allowed for a ±50 percent variation in the purchase of the estimated production requirements. The SAIP price estimates were determined by using the option price as a basis for the recurring costs and then adding any spares- or SAIP-peculiar costs. Costs peculiar to spares would include any special testing, packaging and/or burn-in. SAIP-peculiar costs would include any management overhead, and/or handling fees assessed on the item by the prime contractor. The SAIP-peculiar fees were estimated to be around 30 percent.

The procedure through which a firm price is negotiated required 240 days for the F-16 SAIP items. The 240-day period included 120 days for GD to submit its priced spare parts list with firm price proposals from the time GD was notified by the Air Force of the items (and quantities) to be procured concurrently and 120 days to negotiate the price for the items. Any changes to the configuration of the part on order resulted in a renegotiation of the price and another 120 days. Since renegotiation was possible for each change, it was not unusual for the highly unstable parts to undergo several changes in their price estimates before a definitized price was negotiated. It was also not unusual for delivered items to remain unpriced long after their acceptance into the Government inventory.

The pricing experience of the F-16 SAIP items was characterized by (1) very high initial firm price estimates, (2) many re-pricing and re-negotiation activities resulting from design changes, (3) proration of item configurations over a single order resulting in different unit prices for identical or nearly identical parts, and (4) large numbers of undefinitized prices on already-delivered items. This situation came about because of configuration instability of some of the SAIP items, the seemingly overinflated initial unit price estimates for the items and, to a greater degree perhaps, due to the Air Force procedure of issuing new provisioned item orders (PIOs) each time a change in an item's part number occurred. These PIOs resulted in changes to line items on the contract, and were therefore required to exhibit the net impact of the change on the specific funds cited, even in instances where the net effect on funds was zero. The key defect in the Air Force PIO process is that an item's 120-day pricing clock is set back to zero whenever a PIO is issued that includes that item. For the first F-16 SAIP buy alone, 53 PIOs were issued between January 1977 and March 1980 that had some

impact on these first SAIP items. Pricing activity for at least one SAIP item was started anew three years and two months after the item was originally ordered, and 14 months after it was delivered. The general practice for the F-16 AFPRO (the resident--at GD's site--Air Force procurement activity) was to aggregate changes that occurred during some period, say two weeks, into a single PIO thereby minimizing, to some degree, the administrative burden that would result from more frequent PIO issuances.

It was stated earlier that the contractors had the authority to update automatically the SAIP spares it had on order so as to keep the spares configuration consistent with that of the installs. This resulted in a sort of catch-up game for the AFPRO whose job it was to issue new PIOs and to negotiate prices. The notification of changes to spares configurations came from the prime contractor in the form of exhibit PSPLs that indicated both old and new part or dash numbers and the dollar (and or quantity) effect of the changes. Thus, the unit price of the affected item was subject to change as a result of a change in the item's configuration. Since there were no basic unit prices for the items (that is fixed prices), changes affected the item's unit price; the changes were not priced separately and then combined with the unit price. Thus, at any given point in time, it was impossible to know how much the Government would finally pay for the SAIP items. It was also impossible to arrive at an estimate of F-16 SAIP savings. Contrast this with the F-15 SAIP experience where price changes came about only with major (i.e., Class I) configuration changes.

Impact of SAIP on F-16 Initial Provisioning

The initial provisioning for the SAIP spares occurred prior to that of the balance of the recoverable (reparable) investment items. In fact, the computations for the first F-16 SAIP buy predated the conclusion of the F-16

Logistics Support Analysis (LSA) process during which provisioning factors are agreed upon by the Government and the contractor, called ORLA/DORR in the F-16 program. The relevant dates for F-16 provisioning activities appear in Figure 2-2.

The first SAIP requirements were computed manually using AFLCR 57-27 techniques with the exception that an additional 30-day depot stock level was computed. The SAIP calculations were based on two years of support, as it was felt at the time that the Air Force would be authorized to purchase support up front for two years; the initial production contract called for two years plus options. When it was later determined that support for only 38 (rather than 150) aircraft was being authorized, a reduction to the already-computed SAIP requirements was made. The computed requirements were reduced by 75 percent (after the subtraction of the depot level stock which was no longer allowed under AFLCR 57-27).

Had the requirements been recomputed using AFLCR 57-27 and the latest item characteristic estimates for a 38-aircraft program, the results would clearly have been different. For this study effort, LMI did not recompute the quantities to determine the magnitude of the difference; however, we will attempt to do that in a related F-16 study effort in process.

We said above that the first SAIP computations were performed manually. This contrasts with the subsequent SAIP and non-SAIP computations that were performed using the computer model MOD-METRIC, which was used for later procurements to optimize LRU/SRU procurements subject to a fill-rate goal. The SAIP I procurement on the F-16 differed from the subsequent SAIP and non-SAIP procurements in three ways:

- manual computations were performed;
- the final ORLA/DORR provisioning factors had not been arrived at, so preliminary factors were used; and

- the computations were based on a two-year support period, and then deflated to one year.

Without SAIP, initial provisioning would have begun in October 1977 as it did for the non-SAIP items.

Problems with Undefinitized Prices

We alluded above to the problems encountered on the F-16 due to the preponderance of undefinitized prices. One critical effect of the pricing procedure employed on the F-16 is the reduction in management's ability to make adjustments to the total cost to the Government so as to avoid the over- or under-obligation of funds. Another effect may be the expiration of obligation authority before the item's price is definitized, resulting in the loss of funds that were obligated in excess of the subsequently definitized price.

The contractor was also impacted negatively by the undefinitized-price problem. Final billing for the spare parts cannot be submitted by the contractor until prices are definitized. Since changes necessitating new PIOs can be made up to the delivery of the item, this can result in the contractor having to wait up to 120 days (the time it takes for prices to be definitized) before his final billing to the Government. As of 17 April 1979, an estimated $22.4 million in parts had been delivered, yet their prices had not been definitized. This amount represented only about five percent of the then current undefinitized balance. The total undefinitized dollars for SAIP I orders as of 10 April 1979 accounted for roughly 91 percent of the total value that had been placed on order 27 months earlier and delivered six months earlier. [16]

Special Data Requirements

For the first few SAIP applications on the F-16 (SAIP I-V) there was no special or unique data required of the contractor. The contractor supplied the list of recommended items, the quantity of each required (through SAIP

III), and the provisioning factors required for DO41 replenishment calculations (SAIP IV-VI). Recall that the first three SAIP buys were for initial provisioning, and the last three were to cover replenishment needs.

A unique data element was provided by the contractor for the SAIP VI proposal only. This data element was GD's schedule of drop dates, the days GD planned to order production items, to its suppliers. Prior to the time of SAIP VI, the Air Force made a single annual order to GD and the individual drop dates were not required. The F-15 contractor also provided the list of drop dates to the Air Force for the SAIP items. In fact, AFLC is now adding to all spares contracts a new clause requiring the prime contractors submit to the Air Force its schedule of drop dates.

We found, however, that although item managers for both the F-15 and F-16 were provided copies of the prime contractor's drop dates, there was generally no effort to procure replenishment spares directly from the manufacturer or vendor concurrently, with or around the same time that the contractor was procuring production items. In fact, a few item managers expressed surprise at the notion that vendors would identically price identical spares and installs because the spares are always priced differently. There was agreement, however, that the spares prices might be influenced by the concurrent production of spares and installs. However, item managers receive quarterly spares computation results and quarterly buying guidelines, although an effort is made to make semiannual procurements. Thus, annual orders timed with the prime contractor's orders appear to be out of the question.

3. RISKS AND BENEFITS OF SAIP

INTRODUCTION

When the term SAIP was originally coined by the McDonnell Aircraft Company (McAir) to refer to their Spares Acquisition Improvement Program, McAir felt that SAIP not only could save money but could actually improve the support of weapon systems. The benefits of SAIP that we discuss in this chapter are for applications modeled after the McAir SAIP concept. This concept involves (1) submitting spares orders directly to the prime contractor, (2) having configuration control and automatic proration clauses in the contract, (3) giving the prime contractor chief responsibility for ensuring on-time delivery, and (4) pricing the spares order at the same time the production installation items are priced.

RISKS TO THE GOVERNMENT

The principal risks associated with SAIP are felt to be derived from ordering the support items earlier than would be the case with conventional provisioning and using the prime contractor's estimates of his vendor's prices. There are several other risks to be discussed, and throughout this discussion we continue to assume that the spares are being ordered through the prime contractor, unless otherwise stated.

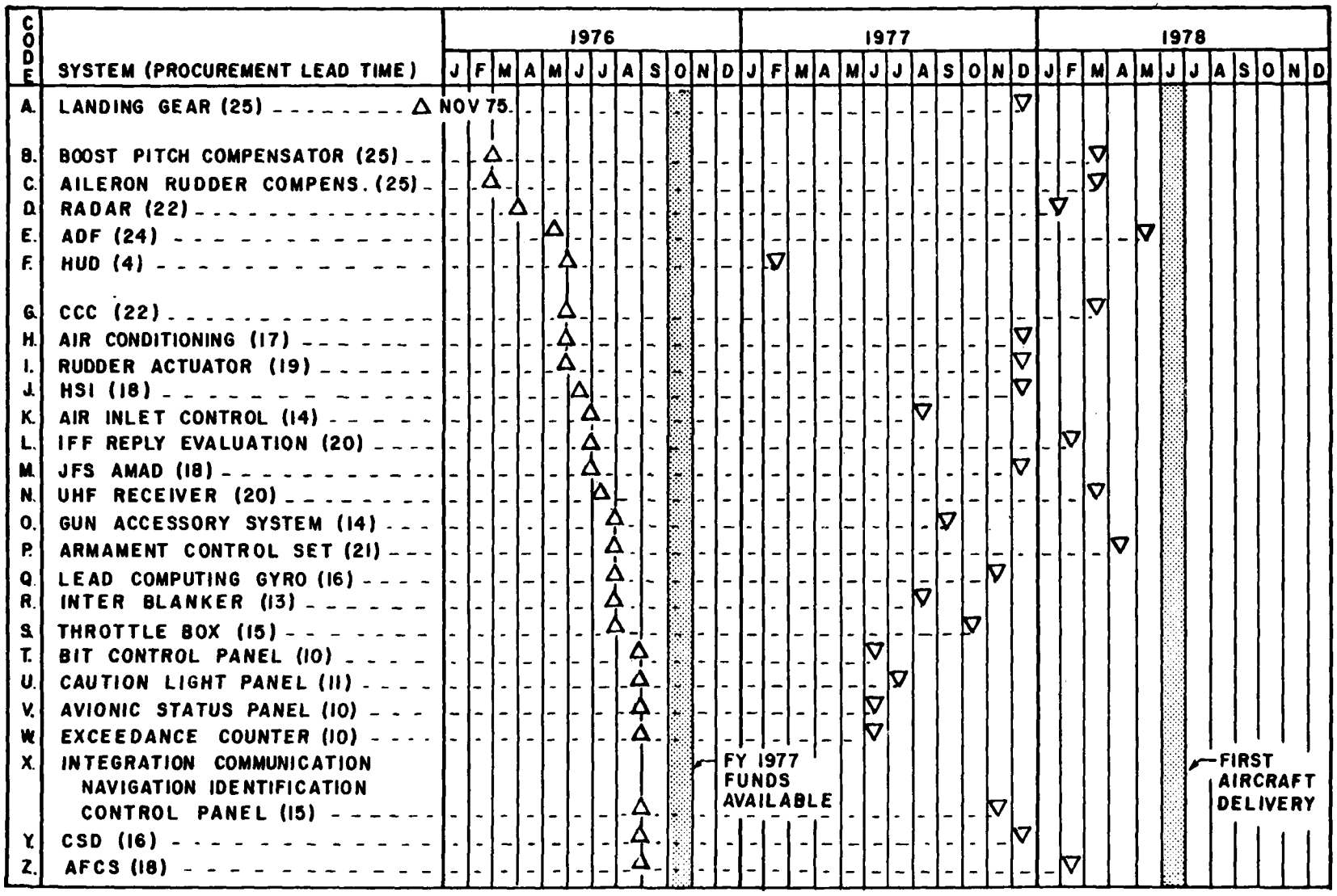
Early Commitment of Funds

The applications of SAIP to date have generally involved the early obligation of support funds, that is, earlier than would have been the case without concurrent purchase orders. How much earlier SAIP orders must take place is the subject of much debate. Recent market trends have resulted in many items having leadtimes sufficiently long that their order dates are in

different fiscal years than are their delivery dates. The long-leadtime production installation items receive advance procurement funds almost as a matter of course. The same is not true for support items. The differences between the policies governing long-leadtime spare and repair parts and long-leadtime production installation items are topics discussed in Chapter 4. We now consider cases where SAIP items (including long-leadtime items) may or may not have to be ordered appreciably in advance of normal non-SAIP procurements and the various implications. The issue of early procurement for SAIP items takes on a different aspect for each case.

Let us first consider the schedule of a prime contractor's drop dates with his suppliers for long-leadtime items indicated in Figure 3-1. Let us assume a support item lay-in period of 30 days prior to delivery of the first aircraft. Let us also assume that the procurement leadtimes (as indicated by the time between the order date and the date of delivery to the prime) are the same ones faced by the Government. We then find that under a SAIP application the Government would be required to place its orders for these long-leadtime items from zero (for the ADF system) to 15 months (for the HUD) prior to the implicit individual PLT ordering dates. In particular over 65 percent of the items can be ordered within six months of their implicit PLT ordering dates, 31 percent of the items would be ordered between seven and eleven months of their implicit individual PLT ordering dates, and one item would have a SAIP ordering date occurring 15 months prior to its implicit PLT ordering dates. We have calculated the differences between SAIP and PLT ordering dates for support item lay-in periods of 30, 60 and 90 days. The results are contained in Table 3-1. What is interesting to note is that with a lay-in period of 90 days, over 57 percent of the long-leadtime items could be purchased within three months of their implicit individual PLT ordering

FIGURE 3-1. PURCHASE ORDER RELEASE SCHEDULE



NOTES: △ DENOTES DATE CONTRACTOR SUBMITS ORDER TO VENDORS, AND

▽ DENOTES DATE OF FIRST AVAILABILITY OF THE ITEMS ON ORDER.

dates; over 73 percent can be purchased within six months of the conventional ordering date. The F-16 program had a 90-day lay-in during the initial provisioning period. Thus, the number of months prior to the item's implicit PLT ordering date that a SAIP item must be ordered is, for this example, extremely sensitive to the date the spares are required for the lay-in period.

TABLE 3-1. SAIP VS. PROCUREMENT LEADTIME ORDERING DATES FOR SELECTED LONG-LEADTIME ITEMS FOR THREE LAY-IN PERIODS

	PERCENT OF ITEMS		
DIFFERENCE IN MONTHS	30 DAY LAY-IN	60 DAY LAY-IN	90 DAY LAY-IN
0-3	30.8	34.6	57.7
4-6	34.6	34.6	15.4
7-9	15.4	15.4	23.1
10-12	15.4	11.5	0.0
13-15	3.8	3.8	3.8

We have been referring above to long-leadtime items--those production installation items whose ordering dates precede the fiscal year's availability date for funds. When concurrent ordering of spares and their related long lead production installation items occurs, the spares automatically become long-leadtime spares although their implicit PLT ordering date would not necessarily qualify them as such. These are the spares for which full funding would be required; advance funding would be required for the long-leadtime production installation items. The issue of requesting funds for spares before funds become available for the fiscal year is discussed in greater detail in Chapter 4. We only wish to note here that DoD funding policy differs for spares and production installation items. Funding approval for the purchase of long-leadtime spares in advance of their implicit PLT ordering date is discretionary and may vary from item to item, from program to program and from Service to Service.

The ordering of spares from zero to six months prior to their conventional ordering dates may be seen as acceptable by Service Comptrollers in view of the expected SAIP savings. The decision to apply SAIP when the SAIP order date occurs more than six months earlier should take into account the greater risks of over/underprocurement due to changing item characteristics, and of program uncertainties (e.g., cancellations and stretchouts) due to the earlier order dates.

There is a compromise possible, however, for items whose SAIP order dates are exceedingly far in advance of their implicit PLT-away ordering dates. The compromise--buying the SAIP items along with production installation items for a subsequent year--is indicated for four out of 26 long-leadtime items. Items F, T, W, and X have PLTs of eleven or more months. Yet the implied SAIP order dates for these items result in a leadtime's worth of dead time--the period between the contractor's and the Government's material need dates--for each of the four items. Therefore, the feasibility of buying these items with subsequent fiscal year buys should be explored. This would appear feasible since through SAIP these items are ordered at least two PLTs away from the Government's materiel need date; the assumption is that the prime contractor orders these items annually. There are two obvious risks to this type of strategy: (1) if the basic part undergoes configuration changes between the time it is installed and the time before the spares are ordered, the next year's configuration of the spare may not match the previous year's installed item's configuration and (2) if the item's procurement leadtime increases from one year to the next, the Government could run the risk of not receiving the spare parts when required. Both risks are also present with conventional PLT away ordering dates.

We note from Figure 3-1 that all of the items can be considered long leadtime items for SAIP purposes; that is, if the Government wishes to order the parts concurrently with the production installation items for the same fiscal year it must release procurement funds in advance of the fund availability date. However, a full 17 of the 26 items, 65 percent, would not require early release of funds if they were procured PLT away from the need date. If the lay-in period were 90 days, the percentage of items that could be procured without advanced funding drops to 46 percent. What is important to note here is that the existence of long-leadtime production items does not necessarily imply that the related support items also have long procurement leadtimes. The long-leadtime status of the production item is dependent upon both the item's PLT and the item's need date for installation and/or burn-in purposes.

Use of Prime Contractor Price Estimates

In spite of potential benefits derived from economies of scale and learning curve savings, the Government does run some risk in procuring spares concurrently with installation items. One risk was described in Defense Audit Service Report No. 80-034 [5]. The DAS concluded that it is unacceptable to use the prime contractor's estimates of his vendor's prices to compute SAIP savings due to uncertainty in these prices. The conclusion was based on a review of two out of the 30 radar subsystems with computed requirements. The 1974 negotiated unit prices for the two subsystems were lower than the 1973 prices presented to the Government by McAir. Table 3-2 (Table 2-2 represented here for the reader's convenience) reproduces the DAS Table.

Excesses/Overprocurement. One risk the Government faces in buying whole systems, e.g. radars, is the receipt of items for which no current requirements exist, or in quantities in excess of currently identified needs.

TABLE 3-2. F-15 RADAR PRICES AVAILABLE TO THE GOVERNMENT MAY 1973

Noun	AFLCR 57-27 Reqmt	Estimated Unit Price	Qty Bought	Total $ If Bought at DATS Price	Qty Over-Bought	$ Over-Bought
Wave Guide	9	$ 423	8	$ 3,384	0	$ 0
Wave Guide	1	423	8	3,384	7	2,961
Wave Guide	9	423	8	3,384	0	0
Wave Guide	9	423	8	3,384	0	0
Wave Guide	1	254	8	2,032	7	1,778
Wave Guide	9	254	8	2,032	0	0
Oscillator	16	182,958	8	1,463,664	0	0
Wave Guide	1	1,300	8	10,400	7	9,100
Transmitter	16	225,607	8	1,804,856	0	0
Receiver	8	166,669	8	1,333,352	0	0
Divider	21	1,269	8	10,152	0	0
Antenna	19	301,846	8	2,414,768	0	0
Processor	13	198,411	8	1,587,288	0	0
Processor	29	315,627	8	2,525,016	0	0
Processor	19	294,900	8	2,359,200	0	0
Control	8	11,000	8	88,000	0	0
Power Supply	11	109,633	8	877,064	0	0
Antenna	1	790	8	6,320	7	5,530
Antenna	1	750	8	6,000	7	5,250
Divider	1	50	8	400	7	350
Antenna	1	1,258	8	10,064	7	8,806
Antenna	1	1,258	8	10,064	7	8,806
Divider	1	1,626	8	13,008	7	11,382
Divider	1	1,626	8	13,008	7	11,382
Wave Guide	11	535	8	4,280	0	0
Wave Guide	9	439	8	3,512	0	0
Wave Guide	9	561	8	4,488	0	0
Wave Guide	9	513	8	4,104	0	0
Gasket	1	1,338	8	10,704	7	9,366
Horn	1	1,144	8	9,152	7	8,008
Total Cost Per (1 Sys) Normal Provisioning Procedures		$1,823,308	(8 Sys)	$14,586,464		$ 82,719 Amt. Over-Bought
Cost of 1 System on McAir's Option		$ 803,800				
Estimated Savings Per System		$1,019,508				
Estimated Savings for 8 Systems		$8,156,064				

Net savings for 8 systems = gross savings minus amount overbought
= $8,156,064 - $82,719 = $8,073,345

Note: The two subsystems reviewed by the Defense Audit Service are boxed above.

If it is anticipated that the items will be required as the number of end items in the system increases, then the main concern becomes the risk of modifications or obsolescence. It would appear that these risks can be quantified and should, in fact, be examined before the purchase of shipsets is made. If, on the other hand, the items have no anticipated needs then the items are unquestionably in excess, though the cost savings may warrant the procurement of items for which no requirement may exist until later in the program.

Shipsets vs. Major Components of Shipsets

The radar procurement that DAS reviewed involved the purchase of entire radar shipsets. This is not the way the military normally purchases support items. The purchase was made possible because the prime contractor exercised his vendor options allowing a variation of 50 percent from estimated production installation requirements.

Fifty-six Percent Savings. The data the Government had available to it at the time of the F-15 radar purchases indicated that savings of 56 percent per radar could be realized by buying the entire sets concurrently with the production requirements (see Table 3-2). This is based on the priced spare parts list (PSPL) and the data accumulation/transmittal sheets (DATS). The PSPL does contain negotiated prices. This brings up the question of whether firm prices ought to be negotiated for SAIP items before the order is placed or whether not to exceed (NTE) prices should be used with negotiation taking place at a later date. The ordering dates of the SAIP and non-SAIP purchases were not of primary importance since they both were in the same fiscal year.

Firm Prices vs. Not-to-Exceed Prices

There is one assumption that seems to be made by the Government concerning manufacturers' estimates of their products' unit prices: manufacturers generally tend to err on the low side, especially during the initial years of production. Assuming this, and faced with large potential savings, it would certainly seem prudent for the Government to firm-price the spares. Firm prices can be viewed as a hedge against the uncertainty surrounding the manufacturer's estimates. Not-to-exceed prices, on the other hand, can be considered as a hedge by the contractor against the uncertainty surrounding his estimates of unit costs. Clearly, the Government and contractor perceptions of uncertainty in unit prices should depend upon the past experience of each concerning similar purchases under similar circumstances.

Overprocurement/Underprocurement

We have defined SAIP as an alternative spares acquisition strategy whereby spares requrements are consolidated with requirements for production installation items. As such, SAIP should have no bearing on the spares calculation methodology employed by the program managers. SAIP is implementable only after a decision has been made to buy a specific range and depth of support items (although planning for SAIP may occur much earlier).

Acceleration of the Provisioning Activity. We have stated earlier that past SAIP orders have generally occurred prior to the PLT of the item. It is therefore conceivable that between the SAIP order date and the implicit PLT order date there may occur updates to the provisioning factors used to calculate requirements, or to the scope of the program. It is not unusual for estimates of item characteristics to remain unchanged during the demand development period. Exceptions to this would be if early usage data and/or test data indicate that the estimates are significantly off; even then there would

be a tendency toward conservatism until "enough" data were collected. If the initial provisioning factors were determined prior to the SAIP order date, there should be no difference between the SAIP quantity and the quantity that would result with later procurements. If the time between SAIP and conventional ordering is short, this problem could be negligible.

Effects of Configuration Control Clauses on Perception of Risk

For unstable, costly items the general DoD policy is to be conservative and to defer some or all of the procurement of computed requirements, if possible. This is the Phased Provisioning approach proscribed in DoDD 4140.19. The fear of buying total computed requirements for unstable items outright is chiefly that of receiving obsolete items or items that will require retrofit or modification, perhaps even before they are required for service. SAIP's configuration control and automatic proration of design change clauses may cause provisioners to be unduly confident in ordering the full complement of requirements, rather than buying a portion of computed requirements or deferring the purchase altogether. Generally the uncertainty concerning an item's operating characteristics is not incorporated into the spares computation formula in that most requirements models assume that reliability and maintainability estimates are known with certainty. We do not have the data to support it, but we feel that SAIP may influence the decision to buy the total requirement, rather than buying short for those unstable items.

RISKS TO CONTRACTORS

The major risks to contractors depend strictly on the types of contractual clauses used for the SAIP application. In this sense, the financial risk to the contractor would tend to be greater for well-managed applications.

The two major risks we have identified involve the firm pricing of SAIP spares and the contractual obligation to deliver spares in the latest configuration.

Risks Present with Firm Pricing

The major risk to the contractor from the firm pricing of spares is that the actual cost of the items might be significantly greater than the estimated cost. The result would be an erosion of the contractor's estimated profits for small overruns with the possibility of actually losing money on the contract.

The 1979 Air Force Functional Management Inspection of SAIP stated that to implement SAIP effectively:

> The contract should provide for firm pricing of spares when the order is placed. Normally, a small percentage of the cost would include the administration and management of Class II engineering changes. Costs for Class I engineering changes should be negotiated as part of the normal Engineering Change Proposal process and prorated across the affected spares and production items and should not cause renegotiation of the basic spares price. [7]

This concept was employed, to some extent, for the initial F-15 SAIP purchases. The value of the risk incurred by the contractor, as implied by a "small percentage of the cost", applied to all spares was estimated to be around two percent. However, this two percent was not applied to the cost but to the negotiated spares prices. This procedure conflicts with both Defense Acquisition Regulation (DAR) and Cost Accounting Standards (CAS) Board policies.

CAS policy disallows the inclusion of contingency costs (as opposed to estimates of actual costs). DAR policies state that costs have to be based in fact with no contingencies unless the number is supportable, i.e. based on statistical or other analyses. The two percent was neither supportable nor was it based on fact. It was, in fact, an arbitrary number that was applied

as a surcharge on price, not as an element of the cost and therefore auditable. Thus, the contingency charge was subsequently disallowed. The F-16 application had no such provision and, in fact, utilized NTE prices, not firm prices. This resulted in a potential renegotiation of the price each time a part number changed, adding to the administrative workload, and ultimately to a great quantity of outstanding unpriced orders.

Configuration Control Risks

The prime contractor does not generally act as a depository for SAIP spares while they are awaiting delivery to the Government. It is common to have the spare parts direct-shipped from the manufacturer. However, the prime contractor does bear some risk in ensuring that the spares are of the latest or matching configuration to the installed items. This risk would seem minimal for a well-managed SAIP application.

BENEFITS TO THE GOVERNMENT

There are several benefits to the Government from SAIP including lower unit prices, reduced administrative burden, greater visibility of prices, better configuration compatibility, and enhanced readiness.

Lower Unit Prices

The primary benefit to the Government from a SAIP application is lower unit prices of spares. It is widely accepted that the magnitude of SAIP savings is around 15 percent. This 15 percent figure appears in reports by the General Accounting Office (GAO), the Air Force Logistics Command, the Navy, and other agencies. Although the 15 percent is presumably based on savings documented on the Air Force F-15 program, we have been unable to find a document, from either the Air Force or the F-15 prime contractor (McDonnell Aircraft Company) substantiating this claim of 15 percent savings. We have,

however, reviewed Air Force records that indicate various levels of savings--documented in Chapter 2--and they will not be repeated here, nor will we attempt to validate them. What we wish to explore are the mechanisms behind the cost savings and the other benefits that accrue to the Government.

Reduced Unit Costs. The concurrent release of orders for spares and production installation items results in a lower unit cost for both. The lower spares cost is effected when the supplier is able to plan his raw material purchases better (i.e., buy in larger lot sizes) and schedule his production activities more efficiently. This presumption of lowered unit costs is based on the premise that economies of scale result, to some degree, from having a larger order for raw material buys.

Elimination of Redundant Set-up Costs. The combination of spare and production installation items requirements into a single purchase order from the prime contractor results in the elimination of the generally costly set-up charges. These set-up charges are believed to be one of the largest factors in the differential between spares unit cost and production installation item unit cost. The spares order quantity is often a fraction of the production item requirements, thus resulting in higher set-up charges per unit. Spreading the set-up cost over a larger population of items may also reduce the cost of the installed item.

Learning and SAIP. Learning curve theory states that as the quantity of items produced increases, the unit cost of the items produced decreases. The learning rate of the firm for any given item gives some indication of expected savings as quantity increases. For example, a 90 percent learning curve is one in which a doubling of the quantity produced decreases the unit cost by 10 percent; an 80 percent curve yields a 20 percent reduction upon

doubling production (see Figure 3-2). Since learning takes place for each item produced, the result is a lower average unit cost for the entire lot of items produced. In the case of SAIP, learning can result in lower production installation item costs as well as lower spares costs. When a supplier anticipates separate spares orders, he is likely to assume that he will encounter a discontinuity in production that will disrupt the learning process. In this case all learning may be lost and we are faced with starting the process from scratch or some learning may be retained but there is a penalty for the interruption. Three hypothetical cases are shown in Figure 3-2.

Table 3-3 represents vendor quotes of prices (cost plus contractor earnings) from combining spares orders with those for production installation items, as opposed to purchasing each alone. The savings as a percentage of the respective separate order is also indicated for spares, production installation items and the overall combination of spares and production installation items. The overall savings for spares and production installation items is around 11 percent of the total quoted stand-alone prices. The percent of indicated savings for spares is 25 percent. This table indicates that a greater degree of learning takes place when orders are placed concurrently although other effects may be present in these data.

What is also evident for some items in the table is the effect SAIP has on production installation item prices. The production installation item prices decreased by $5.78 million for a three percent savings. We would not expect the same degree of savings for each item since not all production processes yield the same learning rates.

Previous studies have indicated that there are large discrepancies between production installation item prices and spares prices, the latter being higher. Given that spares are negotiated separately there is certainly

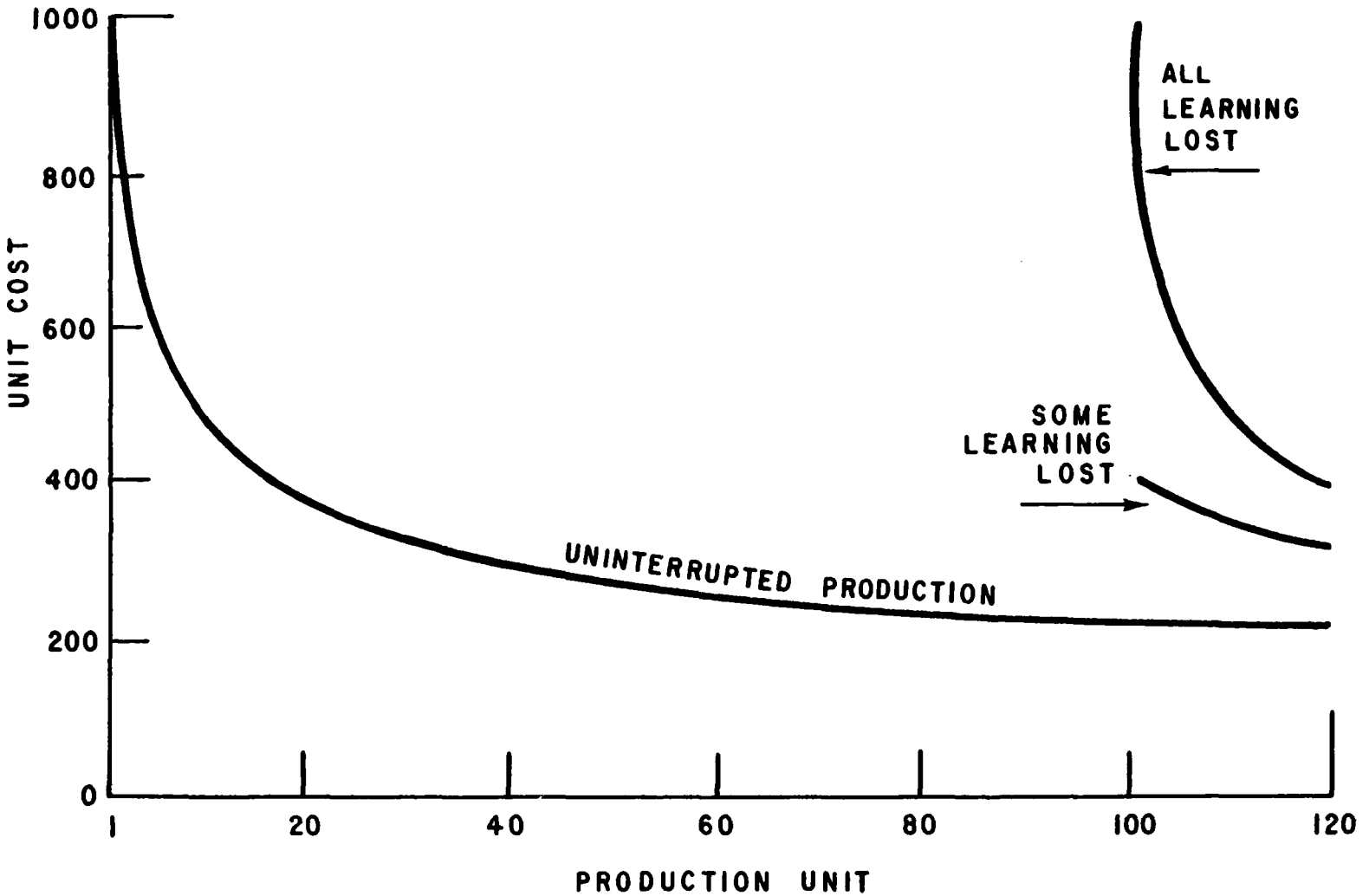


FIGURE 3-2. AN 80-PERCENT LEARNING CURVE

TABLE 3-3. EXAMPLES OF F-15 SAIP SAVINGS (1980)

ITEM		QUOTED STAND-ALONE	COMBINED	SAVINGS	
68-870011	PRODUCTION	$159,140,000	$154,400,000	$ 4,740,000	3%
RADAR	SPARES	102,790,000	75,700,000	27,090,000	26%
68-870045	PRODUCTION	4,999,294	3,959,406	1,039,888	21%
AIC	SPARES	847,179	679,422	167,757	20%
68-870066	PRODUCTION	1,655,034	1,655,034	-0-	0%
SIGNAL DATA REC.	SPARES	703,276	555,860	147,416	21%
68-870063	PRODUCTION	4,186,282	4,186,282	-0-	0%
HSI	SPARES	602,800	542,060	60,740	10%
68-870008	PRODUCTION	14,251,593	14,251,593	-0-	0%
INS	SPARES	2,360,827	2,248,407	112,420	5%
68-690095	PRODUCTION	1,656,255	1,656,255	-0-	0%
SWITCHING VALUE	SPARES	549,472	509,400	40,072	7%
68-810063	PRODUCTION	630,621	630,621	-0-	0%
ELEC. TACH. IND.	SPARES	104,445	62,875	41,570	39%
68-870033	PRODUCTION	367,669	367,669	-0-	0%
AOA SENSOR	SPARES	48,400	33,000	15,400	32%
68-870024	PRODUCTION	4,197,410	4,197,410	-0-	0%
VSD	SPARES	359,032	318,632	40,400	11%
TOTALS	PRODUCTION	$191,084,158	$185,304,270	$ 5,779,888	3%
	SPARES	108,365,431	80,649,656	27,715,775	25%
	PRODUCTION AND SPARES	$299,449,589	$265,953,926	$ 33,495,663	11%

a possibility that the prices may not be consistent especially considering the belief by some manufacturers that pricing policies for spares and production installation items are meant to be different. There is also the possibility that spares ordered separately from production items suffer the effects of a non-continuous production run and re-learning must take place. This situation is illustrated in Figure 3-2 where the disruption results in a shift in the learning curve. For our example, the unit cost of 120 items ordered concurrently is much lower than the combined cost of buying the items separately. In fact, the unit cost of the first 100 is also lower for the combined run than for the separate runs. Thus, lowered costs for installed items, through SAIP applications, is also seen as one of the benefits of SAIP.

Reduced Administrative Burden

SAIP applications can lessen the administrative burden to the Government by (1) the Government having to monitor only a single contractor, (2) the prime contractor taking responsibility for on-time delivery of vendor direct-ship items, (3) having a single contract with the prime contractor rather than a different spares contract with each vendor, and (4) combining the pricing activities for the production installation items and spares. The first three items are not necessarily peculiar to SAIP since they may also be present when spares are simply ordered through the prime and no effort is made to combine the requirements. The fourth benefit derives from the concurrency of the orders.

Greater Visibility of Prices

A further belief concerning SAIP applications is that the combination of spare and install requirements into a concurrent single order gives greater visibility of both spare and production installation item unit prices. With conventional ordering, the orders are managed separately. It is not

unusual for the spares procurement officer to be unaware of the timing and quantity involved in the installation item procurement. Furthermore, since the non-SAIP procurements generally occur on different purchase orders, the Government auditors may not have readily available to them the information they need to ensure consistent pricing of spares and production installation items.

A properly managed SAIP application eliminates this situation. With SAIP, the prime contractor and the Government contract administrators have total visibility of the pricing history for both spares and production installation items. The spares order is negotiated at the same time as the install items thus allowing the negotiator to obtain some evidence that the estimates of prices are consistent. Subsequently, the impact of design changes on spares can be included with the ECP for the end item change and, again, the negotiator has a better opportunity to assess the reasonableness of the price associated with the change to the spare.

SAIP is a more reasonable and auditable approach to negotiating prices for spares and reduces the administrative burden of separately auditing and monitoring contractors' pricing activities for support items and production installation items.

Compatibility of Spares and Production Installation Items

One advantage of SAIP described in AFR 800-26 is that the compatability of items installed during production and spares is assured. In spite of this belief, opponents of SAIP argue that the risk of design changes and obsolescence is greater with SAIP. The fear of obsolescence seems to be founded on the belief that since parts are ordered early, design changes that occur may result in having parts on order that are no longer usable on the end

item. We believe that this fear is unfounded if a SAIP application is properly managed.

Spares Produced and Updated Along With Production Installation Items. Under an effective SAIP application, spares and installation item production is completely integrated. For example, if the supplier has an order for 24 of part A to be delivered four times during the year and four of the items were for support as opposed to installation in the end item, the supplier would perhaps release every fifth item produced as a spare. If a design change occurs at some point during the production run, the supplier receives instruction from the prime contractor on the proration of spares. The result is that the spares are configured similarly (and in proportion to) the installed items. This management of spares configuration is possible only if some actor in the provisioning process has total visibility of the number of spares and production installation items on order, their delivery dates, and the specific end items the spares are intended to support. For SAIP applications, the prime contractor plays this central role of manager.

Updating Non-Concurrent Spares Orders. Under present practice if the supplier has an order to deliver four type A-1 parts during a fiscal year, he may not be able to associate those parts with a specific lot of end items. If the type A-1 parts he produces for production undergo a design change halfway through the year with the resultant new part number A-3, he may deliver half of the production installation items for installation into the end item in configuration A-1 and half with an A-3 configuration. However, it may take a while before the spare parts provisioner both discovers the changed production installation item configuration and gets a new order to the supplier to stop producing type A-1 and start producing type A-3 for support of specific end items, since the managers for spares and installed items are not generally

the same. Thus the automatic proration of spare part configuration is directed by some key actor in the provisioning process, namely the prime contractor. His ability to direct the production of the newly configured item without having the amended contract in hand, is seen as a more expedient and efficient way of ensuring the compatibility of the spares and the designated production installation items they are meant to support.

Readiness Benefits from SAIP

SAIP enhances weapon-system readiness but not because spares are delivered significantly earlier than they would otherwise be. Given the need dates for spares typically specified by the Services, spares are not delivered significantly earlier with SAIP, at least for many acquisition programs.

Consider a program in which the military department specifies pre-positioning of initial spares, say, 60 days ahead of the delivery of the first end item. In the case of tactical aircraft such as the F-14, F-15, F-16, or F-18, the production flow-time of the aircraft is quite short and the earliest need dates for most of the vendor-supplied components to be installed in the aircraft are only about four months ahead of the aircraft delivery date. Thus, spares are required almost as early as the first production-installation items because of the specification of the need date for the spares. In the case of foreign military sales, need dates for spares are routinely specified as early as five months ahead of the delivery date of the first end item so that freight forwarders are able to use surface transportation. This situation results in spares actually being required before production installation components.

The specification of an initial spares delivery date 60 days ahead of the delivery of the first end item is not unusual; we observed it in the

Air Force's management of the F-16 program and again in the Navy's F-18 program. Given this strategy, spare components are needed at roughly the same time as production-installation components and SAIP, the concurrent ordering of spares and installs, seems to make eminently good sense. The point is that SAIP, per se, does not yield enhanced readiness by earlier delivery of spares than a "leadtime-away" strategy. Need dates for spares are essentially a matter of program management policy.

In the case of an end item that has a much longer production flow time than a tactical fighter, production-installation items may be needed well in advance of the delivery date of the end item. In that case it may not seem as attractive to order spares concurrently; however, SAIP has characteristics that are sufficiently important to weapon-system readiness that it may be a cost-effective strategy even for weapon systems with very long production flowtimes. The longer flow-times can be compensated for by the contractual specification of delivery dates for spares that are consistent with the delivery dates of the end items.

There are two characteristics of SAIP that are especially important to weapon-system readiness. The first of these is that SAIP guarantees the same procurement leadtimes for spares as for production-installation components. In the case of a component whose production requires critically scarce material or constrained production capacity, the prime contractor must place his order for that component sufficiently far in advance to ensure that he will not encounter work stoppages in his own production due to lack of that component. In doing that, given the use of SAIP, he essentially ensures the availability of spares right along with production-installation components since both will have the same procurement leadtime. It is also important to note that the prime contractor tends to be much more sensitive to material

scarcity and other constraints faced by his vendors than government procurement activities are since his profit depends heavily on meeting his production delivery schedules. The end result is that SAIP tends to militate against tardy delivery of spares.

The second characteristic of SAIP that enhances readiness is that, given the use of the right configuration clauses, spares will be delivered in the same configuration as the production-installation components. This issue was discussed previously.

Clearly, weapon-system readiness may be enhanced by other characteristics of a spares acquisition strategy of which SAIP is only one ingredient. The ability occasionally to use as a spare an item intended for production installation; the use of contractors' ability to perform depot-level component repair prior to the time organic repair capability exists; and the exploitation of the prime contractor's product support organization are examples of ways in which a spares acquisition strategy can be shaped to enhance readiness.

SUMMARY

The major benefit attributed to SAIP is lowered prices for spares. Lowered prices for production installation items can also result from a SAIP application. In fact, an important benefit of a properly managed SAIP application could be fair and reasonable prices for both spares and production installation items from the very beginning, thus eliminating what is known as the "buy-in" phenomenon.

4. DoD POLICIES GOVERNING PROVISIONING

BACKGROUND

Current DoD policies concerning the initial provisioning of end items are clearly biased towards cost conservatism. This conservatism is evidenced in policies favoring leadtime-away procurements, minimum purchase-order quantities and the deferral of the purchase of part or all of the computed requirements for certain items. These policies are indicative, to some degree, of the amount of uncertainty surrounding DoD procurements. The source of this conservatism stems from uncertainties about component characteristics and requirements and from defense appropriations that fluctuate from year to year, leading to uncertainties in defense programs' scopes, schedules, and priorities. Multi-year contracting, which could do a lot to eliminate much of the uncertainty, is not often practiced and is, in fact, not currently encouraged. The same is true for advance funding of components on weapon systems.

Although there are no current policies that expressly prohibit the use of SAIP, the policies are less than encouraging. In this chapter we examine the DoD policies concerning provisioning and their impact on SAIP.

BASIC PROVISIONING OBJECTIVES AND POLICIES

There are three elements to the basic policies and objectives of provisioning as set forth in DoD Directive 4140.40 [3]. These three elements are:

- to assure the timely availability of minimum initial stocks of spares,
- to provide this support at the least initial investment cost, and
- to sustain the programmed operation of end items until normal provisioning can be effected.

The concurrent ordering of spares and production installation items was shown to enhance the achievement of each of these objectives in Chapter 3 of this report. The policies that are expounded in this directive, however, are not always compatible with the application of SAIP.

Leadtime-Away Procurements

DoDD 4140.40 states that on complex end item programs the release of funds for the purchase of spares will occur both incrementally and procurement-leadtime-away from initial outfitting/lay-in support dates. This manner of obligating funds may lead to uneconomical order sizes potentially resulting in redundant set-up charges, increased administrative burden, and considerable uncertainty for the manufacturer concerning the receipt and size of Government orders. It is stated that this policy may be waived when it is determined to be uneconomical to release orders incrementally, but the burden of proof appears to rest with the procuring agency. This policy it would appear, is not often challenged. On-again, off-again procurement practices and the small size of Government orders have been cited as contributing factors in the generally acknowledged decline in the defense industrial base [14].

It is not uncommon for the Government procuring agency to lump together its requirements into one annual buy. This purchase is generally scheduled PLT away from the first need date. This type of PLT ordering would realize certain economies of scale and reduction in administrative costs, but since SAIP would offer further cost reductions, at no significant increase in risk, the SAIP approach should be the preferred one.

Minimum Initial Stocks of Support Items

It has been stated elsewhere in this report that SAIP, in and of itself, should have no bearing on the range and depth of spares acquired if

the SAIP order date is not significantly in advance of the implied PLT-away date. DoDD 4140.40 states that during the initial support period the Service may want to take calculated risks by deferring the procurement of partial quantities of spares. SAIP can accommodate this decision. We stated earlier that SAIP can be implemented only after a decision has been made as to the range and depth to procure. If operating program uncertainties are such that a decision is made to buy short, SAIP would seem to have an even greater benefit for those items by (1) resulting in a smaller unit cost of the smaller quantity of spares by the realization of economies of scale (based on the production installation items and spares buys), (2) by assuring enhanced management of the configuration of the selected items, and (3) by insuring that the smaller Government spares order receive the same consideration as the larger contractor order for production installation items.

Assuring Timely Availability. This last point can be viewed as a way of achieving objective one cited above. It is well accepted that Government orders do not always receive the same consideration or priority when it comes to adherence to delivery schedule. Under SAIP the prime contractor takes over the job of manager and presumably uses the clout afforded to him by his position. The prime contractor can also borrow from production those items which are needed to meet the emergency needs of the Government, thereby lending to the SAIP application some of the benefits of phased provisioning and contractor support.

Dependence on the Contractor

DoDD 4140.40 also provides for dependence on the contractor for support of selected, costly, unstable items. The elements defining this

contractor support are:

- remove and replace activity of the spares by the using activity,
- contractor repair of unserviceable items, and
- contractor-furnished/contractor-owned spare and repair parts or the utilization of his in-production inventories and capabilities.

The selected contractor support items are generally phased over for organic support when the design stabilizes. The selected contractor-owned support assets, it is further stated, "normally will be procured to the extent needed to fill initial support requirements" [3;5]. The assumption is that the balance of the items will be absorbed into production.

This type of contractor support can be thought of as full contractor support. The difference between this kind of support and phased provisioning is that, under the total contractor support case, no provisioning activity takes place, necessarily, and under phased provisioning the provisioning activity not only takes place, but the items enter the Government's inventory when they are requisitioned.

Under either contractor support and phased provisioning, it is not clear that the price the Government eventually pays for the selected spares will reflect any discounts associated with the larger lot size (production installation items and spares) although it is very likely that they are procured concurrently with production installation items.

The objective of using the contractor's assets for support is a decision dependent upon both the organic maintenance capability of the using Service and the uncertainty surrounding the operating capability and configuration of the spares. Clearly, it is possible to buy outright the components to be used by the contractor. This method of contractor support is frequently

used by DoD Components. To ensure compatibility between spares and production installation items, it makes eminently good sense to procure the items concurrently, provided that the risks of program cancellation or uncertainty in quantities required are not too great. This is especially true for phased provisioned items. The following paragraph appears in DoDD 4140.40 concerning the supporting objectives in furtherance of the principal objective we cited above:

> To program the use of contractors' in-production capabilities to assist in initial supply support through the application of phased provisioning techniques ... and such other management techniques as may be developed to reduce initial investment costs [3;3].

To this paragraph we would add the following:

> One such management technique is the concurrent ordering of spares and production installation items when such concurrency can be economically justified or is justifiable for support considerations, that is, the timely availability of the spares.

The ordering concurrency should provide for a reduction in the initial investment cost for the spares, especially in those instances when the spares would ordinarily be ordered from the prime contractor, but at various times during the fiscal year. This situation is generally present during the initial provisioning period.

Risks Biased Towards Cost Conservatism

The risks that provisioners are expected to take are somewhat biased in the direction of cost conservatism. The following paragraph from DoDD 4140.40 illustrates this:

> Supporting objectives in furtherance of the principal objectives, stated above, include the following. ... To take calculated risks during the initial support period by deferring procurement of partial quantities of computed requirements for selected support items whenever operating program uncertainties or other special circumstances make such risks acceptable in the context of available resources [3;3].

On the side of fiscal conservatism it may prove worthwhile to add the following paragraph:

> To take calculated risks during the initial support period by the procurement of quantities not in excess of computed requirements of selected spares in advance of the individual items' procurement leadtime to take advantage of economies resulting from concurrent procurement of production installation items and related spares.

The addition of this statement, or one similar to it, would allow for the consideration of SAIP in the provisioning of end items of equipment.

Other Advantages of SAIP

SAIP can aid in the furtherance of at least four additional objectives listed in DoDD 4140.40. These are listed below:

- To screen manufacturers' part numbers and other reference number data during the provisioning process so as to prevent unnecessary or duplicate items from entering the supply system.
- To fully coordinate [sic] among using DoD Components the provisioning plans, decisions, and support for multiservice-use end items.
- To develop uniform technical documentation requirements for use by DoD Components and contractors in the provisioning process.
- To assign uniform codes for management purposes to support items during provisioning. [3;3]

The mechanisms through which a properly managed SAIP application implements these objectives stem chiefly from the fact that the prime contractor (1) acts as manager for the SAIP items, (2) has visibility over the manufacturers' part numbers and can coordinate the assignment of uniform reference numbers for each using DoD Component, and (3) coordinates the provisioning activities of each using component. This latter point is important, especially in multiservice applications.

PHASED PROVISIONING

Phased provisioning, as described in DoD Instruction (DoDI) 4140.19, is a management refinement to the provisioning process whereby a decision is made to defer procurement of all or a portion of computed requirements for selected

high cost items until a later stage of production. The principal reason behind the deferral of the spares procurement is to allow time for the provisioning activity to more reliably predict requirements. Thus, phased provisioning is applied to either unstable items with anticipated demands or to items for which no anticipation of demands exists (insurance items) and items with a high degree of uncertainty surrounding their operating characteristics.

The items for which procurement is deferred or for which only a portion of the requirements is procured are generally held in a buffer stock by the prime contractor. This buffer stock is created by having the manufacturer produce the items in advance of the material need date for production purposes. Thus, phased provisioning is a spares management technique which, like SAIP, allows the contractor to procure spare parts along with production installation items.

SAIP vs. Phased Provisioning

DoDI 4140.19 states: "In-production buffer stock material will be accounted for and financed similarly to advance procurement of long-leadtime items." This, and the fact that phased provisioning is required on all complex weapon and support systems and high-cost end items of equipment being procured by the DoD Components, should ensure the timely support of end items, but may not provide the savings that could result from a properly managed SAIP application.

Another distinction between phased provisioning and SAIP is that the SAIP spares have scheduled delivery dates and can therefore be released ahead of specific demands. Phased provisioning buffer stock items are released only upon demand. If no demands for them occur before a specified date, they are generally installed into the end item as a production installation component.

Further distinction between phased provisioning and SAIP is that if the buffer stock items are requisitioned, the prime contractor must then place an order for the items demanded in order to replenish his production stocks. The timing of the order would not generally occur on the contractor's annual drop date with his supplier and would therefore receive no benefits from economies of scale. If the order were for expeditious delivery of the items, it could possibly carry a premium for the accelerated delivery, in addition to any management, handling, and/or administration charges. It is conceivable that, if the buffer stock became severely depleted, the production schedule could slip. This is not the case with SAIP where spares maintain separate delivery schedules and the total computed requirements are ordered.

Phased Provisioning and SAIP

We have stated before that SAIP can be implemented only when a decision has been made to procure a certain quantity of an item. It is therefore possible to apply both SAIP and phased provisioning to selected items. The quantity of the item the military component wishes to procure outright could be procured concurrently, with the balance of the computed requirements being either deferred or having some portion placed in a buffer stock. It would appear, however, that many of the reasons one would use for justifying the existence of a buffer stock may be diminished with the protection afforded by SAIP contractual clauses. For example, the configuration control clauses afford some relief from the risk of receiving obsolete items into the inventory, and the risk of receiving improperly configured items. Yet SAIP cannot protect against the uncertainty surrounding the quantity of items required to support the end items. For costly items for which this uncertainty is great enough to justify the deferral or postponement of procurement actions, phased provisioning may be the preferred management technique.

For programs with lengthy production runs, the overprocurement of items would tend to carry less risk, assuming that configuration control clauses were in effect, because the unnecessary items can be used to support the subsequent years' end items. There is also the possibility of returning excess items to production in the event of excesses, but this would require proper contractual clauses.

FUNDING OF SPARES

The basic belief prevalent throughout all DoD components is that spares are to be purchased procurement leadtime away from their need dates. The procurement activity can occur annually, semi-annually, quarterly, or on an as-needed basis. The timing of spares procurements is a function of the availability of funds and, at times, the item's need date. For example, item managers often get quarterly provisioning guidelines informing them of the funds available and quarterly reports indicating the items required, yet they often will receive expedite orders requiring immediate attention.

In recent years there has been a trend towards expanding leadtimes for components, especially those requiring scarce raw materials. The result has been that some spares and repair parts not only have procurement leadtimes that exceed the fiscal year, but also have PLT ordering dates which precede the date for which fiscal year funds are made available. The implication of this is that, for the initial buy, ensuring the timely delivery of spares may necessarily involve making procurements for unapproved programs.

General Full Funding Policy

The general DoD policy behind full funding is the inclusion in the annual appropriation from Congress of the "total estimated cost of a given item" to provide Congress and the public "complete knowledge of the full dimensions and cost" when the program is first presented for an appropriation

[4;2]. This policy is contained in DoDD 7200.4, "Full Funding of DoD Procurement Programs." The "total estimated cost" covers those costs "incurred in completing delivery of a given quantity of usable end items, such as aircraft, missiles, ships, vehicles, ammunition, and all other items of equipment."

The interpretation of the policy cited above is "that funds for the total estimated cost of an item be available in the year in which procurement action is initiated for the item." [4;2] The policy is ambiguous in that it does not explicitly mention whether support items, such as spare and repair parts are to be included in the total estimated cost. This becomes a problem when long-leadtimes require the procurement of spares prior to the availability of the fiscal year appropriation.

Defense Science Board Interpretation. In its report on the defense industrial base, the board summed up DoD 7200.4 by stating that it:

> requires that each annual appropriation request must contain the funds to cover the total costs to be incurred in completing the delivery of a given quantity of usable end items. There is a provision for the use of advanced procurement funding for the purchase of long-leadtime components. However, such components must be stable in design and usable even if the program is cancelled Thus, many long-leadtime items such as raw material, special electronic designs, and forgings cannot be procured [13;69].

This interpretation of DoD's policy would allow for advance funding for stable common end item components only if they were usable on other weapon systems. The question still remains as to whether spares and repair parts are "components" and thus qualify for advance procurement funds.

Advance Procurement

The directive states that under certain conditions the procurement of long-leadtime components, in advance of the fiscal year in which the related end item is procured, may be permitted. DoD programs are approved annually, one fiscal year at a time, and so this advance procurement necessarily involves the obligation of funds against an unapproved program. The

directive further states that this extension of the full funding policy must be applied judiciously. The following passages from the paragraph on advance procurement have been extracted from DoDD 7200.4 to facilitate our discussion of the implications this policy has concerning SAIP applications:

- Long-leadtime component procurement will be limited to those components whose leadtimes are significantly longer than other components of the same end items.

- The cost of the components procured in advance is relatively low as compared to that portion of the end item costs for which funding is deferred.

- It is important, also, that proposals for advance funding be made on a selective basis with full consideration of the applicability of the components to other programs or as spares in the event that the prospective program fails to materialize.

We discuss each of these items, and their application and interpretation by various agencies.

Navy F/A-18 Spares Funding. The following statements appear in a Navy Audit Report concerning the provisioning of long-leadtime spares for the F/A-18 program [12;9]:

> NAVAIR has been unable to obtain approval to budget advance procurement funds for certain long-leadtime aircraft component spares, even though this apparently would benefit the Navy by reducing costs of spares to the F/A-18 aircraft project and by assuring delivery in time to meet OPEVAL and operational support requirements.
>
> DoD Directive 7200.4, Full Funding of DoD Procurement Programs, states that each annual appropriation request must contain the funds estimated to be required to cover the total cost to be incurred in completing delivery of a given quantity of usable end items. In implementing this directive, NAVCOMPT requires full funding of a fiscal year program with the exception of long-leadtime component procurement. This procurement is limited to components whose leadtimes are significantly longer than other components of the same end item. NAVCOMPT does not consider spares in this category and does not qualify them for advance procurement funds.

It would therefore appear that the NAVCOMPT interpretation of DoDD 7200.4 would result in the judicious release of advance procurement funds and only for production installation items. The spare parts would therefore appear to

be subject to PLT-away ordering dates. The question may therefore arise as to how spares with leadtimes significantly in advance of the appropriation availability date are procured? The answer to this question is not obvious in DoDD 7200.4 as we discuss below. The General Accounting Office (GAO) offers the recommendations we cite below.

General Accounting Office Interpretation. The GAO recommended the following in its 1980 review of the Navy's F/A-18 program:

> We recommend that the Secretary of Defense reevaluate the present DoD policy of not allowing long-leadtime funding for initial spares given the Navy problem of using SAIP. The Navy should be allowed to use long-leadtime funding so that it can buy initial spares and aircraft installed parts concurrently and reduce the F/A-18 initial provisioning cost [8;25].

The GAO, therefore, also believed that DoDD 7200.4 precluded the obligation of funds for long-leadtime spare parts until the approval of the program, which coincides with the funding by Congress. The GAO concluded that the DoD restriction, the policy promulgated by DoDD 7200.4, was, to them, somewhat illogical and should be reevaluated:

> It seems somewhat illogical to permit the services to commit substantial amounts for long-leadtime parts and components for installation in the aircraft but disallow commitment of a lesser [sic] amount for initial spares [8;25].

This sentiment was the same as that appearing in a 1979 Navy point paper on SAIP [3].

DoD Reply to GAO Recommendation. The DoD, it is reported by GAO, stated that the full funding restriction does not prevent the services from requesting full funding for long-leadtime spares or from using the SAIP concept [8;24]. Yet, on page 53 of the same report, DoD's written response to GAO says:

> The SAIP approach comes into conflict with current DoD policies only in those instances where spares are procured far in advance of their need date in order to make spares buys concurrent with production.

> In a multi-lot production program like F/A-18, there are opportunities to place spares orders for selected long-leadtime and normal leadtime items concurrent with a production lot without requiring funding any earlier than non-SAIP procurements. To the extent that spares requirements are computed under the approved DoD procedures (i.e., minimum range and depth), such a limited application of SAIP does not conflict with DoD policies. The Navy is encouraged to apply SAIP in this manner where it is cost-effective.

From this we infer that the DoD would allow for the release of some amount of advance procurement funds. This is not obvious from the directive which distinguishes between components (production items) and initial spares and repair parts (non-recurring requirements).

Advance Procurement for Spares?

The policy we cited above concerned the release of procurement funds for components of the end item. The word component, in the above context, has been interpreted by many to refer to production installation items. As such, it would appear that only production items qualify for advance procurement funds as NAVCOMPT believes. In reference to spares and repair parts, the directive states:

> From a programming and budgeting standpoint, each fiscal year program will be planned in a manner to ensure completion of the effort or delivery of the equipment consistent with the planned delivery of the associated end items. That is, the programming and budgeting will be on a time phased "leadtime away" or "need to commit" basis.

This statement is very clear and direct: non-recurring requirements, including initial spares and repair parts, are to be procured and budgeted for PLT away or as late as you can get away with it and still complete delivery during the fiscal year. The policy does not make it clear whether the advance procurement policy applies to spares. The fact that this policy appears under the heading "Time Phased Procurement" also implies that less than annual buys are preferred.

In the case where the PLT of the spare parts occurs prior to the program approval date, the general belief is that funds cannot be obligated.

Thus, we find that on some programs spares for items with PLTs significantl greater than one year (for example forty months or more) spares orders may no be placed early enough to support the end item because of a perceived in ability by program procurement personnel to obligate spares funds prior t program approval.

It is interesting to note that in a recent DoD memorandum on multi year procurement "non-recurring costs" were defined as:

> Those production costs which are generally incurred on a one-tim basis include such costs as plant or equipment relocation; plan rearrangement; special tooling and special test equipment; pre production engineering; initial spoilage and rework; and specialize work force training [1; Enclosure 1, p.2].

This definition certainly does not include initial spares and repair parts a the definition of "non-recurring requirements" in DoDD 7200.4 does. If th wording in this directive were modified so that initial spares and repai parts were clearly included as end item components, the issue of how to func spares would disappear. What would remain is a policy that would approve advance procurement for both spares and production items in a judicious man- ner. These procurements would be treated consistently and SAIP procurements could then proceed with the only restriction being, perhaps, the proof of SAIP's cost-effectiveness for that particular program.

The question still remains as to whether spares and repair parts do fall under the current definition of components, and are thus entitled to advance procurement funding.

Are Spares and Repair Parts Components?

The policy contained in DoDD 7200.4 is clear both for components (advance funding to be approved judiciously) and for initial spares and repai parts ("leadtime-away" and "need-to-commit" bases for procurements). Yet DoD officials stated to GAO that the restrictions of DoDD 7200.4 did not prevent

the services from requesting full funding for long-leadtime spares. We have reviewed the full funding and advance procurement policy, and we conclude that a restriction does exist that would prevent the obligation of advance procurement funds for initial spares and repair parts. We further conclude that there seems to exist no policy or guidance to cover those instances where the timely delivery of spares and repair parts necessarily involves the obligation of initial spares funds prior to the formal approval of the program.

How to Fund Initial Spares

We believe that the procedure to be followed in the procurement of spares and repair parts in advance of program approval is full funding, given the current policies. We concur with the DoD officials who stated that the restrictions inherent in DoDD 7200.4 do not preclude the services from requesting full funding for spares and repair parts. The request for full funding of spares and repair parts would seem indicated in all instances where the implicit procurement leadtime away ordering date precedes the production approval date. This problem is especially acute in the first year of a new weapon system program.

DOD HIGH DOLLAR SPARE PARTS BREAKOUT PROGRAM

Basic Policies and Objectives

In 1979 DoD promulgated a joint regulation for its military components regarding the method of purchase of high dollar spare and repair parts [13]. The general policies of the regulation can be stated as (1) to make procurements of items on a competitive basis to the maximum extent possible, and (2) to make every effort to purchase spare parts directly from the manufacturers of the items when competitive procurements are not feasible. The principal objective is to break out the costly items from the prime contractor as soon as it makes sense to do so. The term breakout refers to the decision

by the Government to purchase an item directly from the manufacturer or vendor following previous procurements of the same item through the prime contractor. Thus, contractor furnished spares (CFS) can be broken out for both competition and direct purchase whereas Government furnished equipment (GFE) can be broken out for competition only.

Basic Assumptions

The assumptions underlying the DoD Breakout Program are two-fold: (1) competition results in lower item unit prices, and (2) buying directly from the manufacturer or the design control activity is preferable to buying through the prime contractor, when competition is otherwise infeasible. These assumptions stem from the layering effect of adding the prime contractor's loadings (profit, general and administrative charges, for example) onto the basic unit price the prime pays for the item from his subcontractors. The contractor's loadings have ranged from twelve percent to thirty percent for the SAIP applications we reviewed; the contractor can add on even more in the case of foreign military sales. The question to be asked is whether the SAIP item unit cost plus loadings is greater than (or less than) the non-concurrent unit price the Government faces without the SAIP order.

It must also be kept in mind that many of the prime contractor's loadings occur with or without SAIP, in which case the SAIP advantage is the lower unit cost against which the loadings are applied.

Replenishment procurement offers its own problems. When a part is broken out for competition from the original manufacturer (and from the prime contractor) learning may be lost resulting in a unit cost penalty. One study concluded that, even with a new manufacturer, the change in slope of the competing firms' learning curves was dramatic enough to overcome the loss [6;7].

Impact on SAIP

Normally, during the development and initial production of an end item, the prime contractor is responsible for the purchase of all material, parts and components that are used to manufacture/assemble the primary end item. There are exceptions, of course, the principal one being that aircraft engines are normally purchased by the Government and provided to the prime contractor as GFE. Our definition of SAIP has pertained to this initial period of service of the end item--the initial provisioning period. There is no conflict between SAIP application and the DoD Breakout Program during the initial provisioning period for CFS. It is after an item has been coded for direct purchase or competitive procurement that further application of SAIP may violate the breakout policy. Procurement method codes (PMCs) are numbers used to designate the approved purchase procedure for spare and repair parts. We list these codes in Table 4-1. The screening process for items culminating in the assignment of PMCs is generally performed as an adjunct to the initial provisioning process. It is not expected that many items will be broken out during initial provisioning; however, every effort is made to complete the screening process "sufficiently in advance of the first replenishment buy to ensure optimum procurement at that time [5;2-5]."

SAIP applications have generally included high dollar items being furnished by the contractor--high dollar CFS items. These items generally have a PMC code of 5 at the time of initial provisioning. Further screening during the initial period of service may result in a different PMC being assigned. The Air Force Regulation on SAIP, AFR 800-26, stipulates that the

TABLE 4-1. PROCUREMENT METHOD CODES

PMC CODE	PROCUREMENT STATUS OF SPARE PARTS
1	Items screened and found to be already competitive.
2	Items screened and determined for the first time to be suitable for competitive procurement. A replenishment item will be included in this group only when the identification as PMC 2 is supported by the procurement history of the item. The alternative identification is PMC 1.
3	Items screened and found to be procured directly from the actual manufacturer or vendor, including a prime contractor who is the actual manufacturer.
4	Items screened and determined for the first time to be suitable for direct purchase from the actual manufacturer or vendor rather than the original prime contractor for the end items which these parts support. A replenishment item will be included in this group only when the identification as PMC 4 is supported by the procurement history record of the item. The alternative identification is PMC 3.
5	Items screened and determined not suitable for competitive procurement or direct purchase and which, therefore, continue to be procured from a prime contractor who is not the actual manufacturer.

Source: DoD High Dollar Spare Parts Breakout Program, OASD(I&L), March 1969.

decision to use SAIP after initial provisioning would be dependent upon the PMC assigned to the item using the following guidelines:

- Items assigned a PMC of 1 or 2 (competitive) will not be ordered using SAIP.
- Items with a sole source code of 3 or 4 will not generally be ordered using SAIP unless the prime contractor is also the manufacturer. Exceptions to this must be supported by documentation in the contract file.

- Items with a sole source code of 5 may be ordered using SAIP. The regulation assumed that SAIP items were being ordered through the prime contractor.

SAIP's applicability under breakout depends, of course, on whether the production installation items and spares are being procured from the same manufacturer. This is not always the case. In fact, the Government contracting agents for spares and production installation items (1) operate from different funds, (2) are not often in the same physical location, and (3) do not always communicate with one another. Thus, the coordination of spares and production installation item orders under breakout would prove to be administratively difficult. The procurement officers for the production contract also procure on an annual basis whereas the replenishment activity takes place on a quarterly basis.

CONCLUSIONS

Our review of current DoD policies governing provisioning actions for spares and repair parts has yielded the following conclusions:

- There is no policy restriction barring the services from requesting full funding for spares and repair parts on unapproved programs; however, there does exist a restriction barring the obligation of advance funding for these items.
- Advance procurement funds apply only to those production installation items with leadtimes significantly longer than other components of the end item, and not to spares.
- SAIP, as we have defined it, can aid in the furtherance of many of the goals and objectives of the initial provisioning policy contained in DoDD 4140.40.
- SAIP, as we have defined it, does not appear to violate DoD initial provisioning policies.

While SAIP does not appear to be categorically proscribed in any of the policies we reviewed, its use is by no means encouraged or facilitated due to the conservative tenor of the current policy.

There is much in DoDD 7200.4 left to the reader's interpretation. This policy could be improved greatly by the clarification of such terms as components and such requirements as "... funds for the total estimated cost of an item be available in the year in which procurement action is initiated for that item." We concluded that nothing prevented the military components from requesting funds for spares of unapproved programs, but an interpretation of that clause to mean "funding for spares must be initiated in the year in which the end item is procured" may preclude the approval of spares fund requests. This has implications not just for SAIP, but also for the supportability of the end item, in those instances where the PLT ordering date precedes the program approval date; this problem is especially acute in the first year of the program.

5. FURTHER ISSUES

INTRODUCTION

The SAIP concept has been recommended by the GAO for application to DoD programs involving spares procurements. The Air Force has recommended that SAIP be considered for all of its major programs. Yet there are various unresolved issues concerning SAIP applications that have been brought up in the literature. These issues concern the managing, monitoring, item selection criteria, program selection, and the cost-effectiveness of SAIP applications. We discuss these topics in an attempt to assess the potential pitfalls to be avoided, and the desirable clauses to be included in future SAIP applications.

SAIP PROGRAM SELECTION

Air Force Regulation 800-26 states that SAIP is to be used in:

- Each new production estimated to cost $300 million or more.
- Any modification program estimated to cost $100 million or more which requires initial spares support, and
- Any program or project designated by the Commander, AFSC or AFLC.

Thus, according to the Air Force, SAIP is to be applied to new high-dollar programs, high-cost modification programs, or other designated programs. These three types of programs have in common a "hot" production line. This makes sense because the prime contractor purchases installation items only while the production line is still operating.

There are other elements to be considered when deciding whether to use SAIP. The duration of production activities for the end item is especially important, as is the criticality of the end item. SAIP, of course, would not be applied during the first few years if full contractor support were in

effect. Full contractor support, as we defined it in Chapter 3, involves the deferment of the purchase of support items and reliance upon the contractor's supplies and production line capabilities. The potential use of SAIP after the full contractor support period would be indicated for those items with a PMC of 4 (where the prime contractor is also the manufacturer) or items with a PMC of 5. Exceptions to this rule should be on an item-by-item basis with consideration given to the cost-effectiveness of SAIP, the readiness implications of either option, and other service-dictated considerations.

It is generally acknowledged that almost anything can be written into a contract, unless it is illegal. Thus, the SAIP concept would appear to be applicable whenever the proper contractual language exists on paper. The F-16 application is an example of what can happen if the SAIP concept is not introduced to the subcontractors via the production contract, in a timely fashion, yet is later required.

ITEM SELECTION

High dollar spare parts are defined by DoD as items whose extended price (unit price times quantity) for a twelve month procurement period is included in a descending cost-ranking scheme representing 80 percent of the total spares procurement dollars. High dollar spares receive intensive management. AFR 800-26 states that SAIP items should be selected from a cost-ranking down to 65 to 75 percent of the total annual spares budget. This cost ranking scheme generally results in the selection of 10-15 percent of the items as potential SAIP items. The items can be both LRUs or SRUs, reparables and non-reparables. GFE, however, is excluded, as are those items with PMCs of 1, 2 or 3.

Application of SAIP: Government Furnished Equipment

In Chapter 3 we indicated the risks and benefits when SAIP is applied to new end item programs. We concluded that CFS items were the natural choice for SAIP, as we defined it--CFS items being ordered through the prime contractor. But if SAIP is appropriate for CFS, might not the same concept apply to GFE (Government Furnished Equipment)? We feel it should. Unfortunately the separate management of and policy for spare parts and installation items by DoD may thwart the application of SAIP to GFE. Discussion of a few of these management and policy impediments follow.

Separate Funds for Spares and Production Installation Items. Initial spares funds and production installation funds are managed separately. Whereas there are no legal restrictions governing application of the SAIP concept, management difficulties and the use of separate spares contracts inhibit the use of SAIP. The management difficulties stem from the inherent problems of coordinating the requirements of two separate contracting agencies (the prime contractor and the Government): production installation requirements are determined annually, whereas spares requirements are often procured less than annually; that is, leadtime away from need date. If the same procurement officer handled both production installation items and spares buys, to implement SAIP the spares buys would necessarily have to be combined into a single order. The management of SAIP in this case would be less complex; the degree of complexity is dependent upon the procurement officer's (1) ability to submit spares orders in time to catch those of the related production installation items, (2) ability to receive funding for the spares, and, of course, (3) knowledge of the range and depth of spares to be procured. This last point is especially important during the initial period of service of the end item.

TIMING OF SAIP ORDERS

SAIP spares orders should be placed as close to procurement leadtime (PLT) away as is possible. For most of the SAIP applications, the prime contractor has required an order from the Government in time to meet each drop date he has during the year with his suppliers. If the prime contractor has twenty major suppliers, for example, twenty different Government orders would be required, one for each major supplier. The prime contractor normally requires the Government purchase order request in sufficient time (say thirty days prior) to attach the Government requirements to his production requirements purchase orders. If it takes the prime contractor six months from start (arrival of the first installation item) to finish (rollaway from the production line) on any particular lot of end items, and if the Government's material need date for lay-in of spares occurs, say, thirty days prior to end item delivery, then the earliest the Government would order SAIP items would be five months earlier than PLT away.

SAIP Orders Directly to the Design Control Activity

It is conceivable that concurrent procurement of spares and production installation items could be made directly from the design control activity (DCA), i.e., the actual manufacturer or the contractor with primary responsibility for the item. SAIP does not have to be implemented through the prime contractor. For example, engines for aircraft are generally procured not through the prime contractor but through the DCA and are provided to the prime contractor as GFE.

To implement SAIP for items that have been broken out from the prime contractor in this fashion it is necessary for the provisioners to know when the prime contractor's scheduled order dates are with his suppliers. The Service could then time its spares orders to coincide with the orders for installation items.

The advantages of this variation of SAIP are very much the same as those postulated in Chapter 3. The avoidance of the prime contractor's loadings would make the unit price of the items lower than when ordering those same items through the prime contractor (this assumes pricing integrity on the part of the supplier). However, the Government would give up many of the readiness benefits inherent with having the prime contractor act as the procurement manager. Among these foregone or diminished benefits are those resulting from configuration control clauses, visibility of spare and production installation on item costs, reduction of administrative burdens, and the single contract to monitor when spares are ordered through the prime contractor. The ability to draw upon production quantities may also cease.

The Government runs a higher risk of receiving items that have not been updated to the latest configuration, than it does with SAIP through the prime contractor. The conventional way to order spares is by line item: one part number to a line item. If the part number changes, the original spares purchase request is not amended, but superseded. Debits and/or credits are made against the old line item and a new line item is established. This new part number may be subject to a renegotiation in price; if so, it's customary to reprice the spare, not just to initiate an engineering change. The end result is that part number changes require additional administrative work and thus take time. The administrative burden may be placed on the Government or the subcontractor. The fact is that the subcontractor makes deliveries and produces based on the part numbers contained on the purchase order. A contractual clause requiring the automatic update of spares part numbers on order whenever the related production item changes would perhaps help. Yet even this approach has problems because it could lead to many unpriced parts on order. A further contractual clause following a once-priced/always-priced principle

would remedy this, but would require changes perhaps to the Government Cost Accounting Standards, which we discuss in a later section.

Competition and SAIP

Once an item has a PMC of 2--for the first time found to be ready for competition--AFR 800-26 would have the item removed from the SAIP lists. There are at least three possible results from a competitive bid: (1) the contract is given to a different manufacturer, (2) the original manufacturer wins the competitive bid, and (3) the award is split between one or more contractors. Breakout for competition, in this context, refers to spare and repair parts procurements. Let us assume that the prime contractor continues to manage the procurement of the related production items, and also continues to buy from his original supplier.

Under case one--a different manufacturer wins the award--SAIP cannot be implemented. There is no chance of combining orders for spares and production installation items.

Case two would allow the concurrent release of purchase orders. The supplier, if aware of the Government's intention to use the SAIP concept, can release prime estimates based on the combined order rather than estimates based upon the Government ordering small quantities at various points during the year. The anticipation of a combined order for spares and production installation items should also tend to make the firm more competitive because of the (1) inherent economies of scale that a manufacturer providing only spares could not achieve, (2) greater degree of learning resulting from larger lot sizes, (3) reduction in set-up costs, and (4) the effect that competition has on the learning of firms as a whole. This last point, discussed in Chapter 3, involves a change in the rate of learning due to competitive forces.

In the event that there were multiple awards for the spares, SAIP would again be possible but only if one of the competitive firms also manufactured the production installation items.

Competition under cases 2 and 3 has its own risks and additional costs that should be weighed. There are the issues of approval testing, prior qualification of the new source, the rights of data, and duplicate costs to the Government for tooling and other special equipment. There is also the fear of the installed item built by one source not being interchangeable with the spare, although both are made from the same drawings. Appropriate quality control measures should minimize this risk, but time and money are spent contracting for this quality control.

Savings From Competition. A 1979 study touted savings between 27 and 39 percent from competition [18]. This range was based on a sample of 45 programs. The study also estimated savings in the range of 2 to 24 percent for seven missile programs. This same study quoted IDA as having found an overall average savings of 35 percent in 31 programs and a 17 percent average for nine missiles and major missile subsystems. These and many more studies purport to prove that competition saves money; however there is strong evidence that the belief that cost reductions result from break-out is not well founded, given SAIP as an alternative. It was interesting to note, for example, that in the F-15 program, the prime contractor, McDonnell-Douglas, underbid its own vendor on a spares contract for certain F-15 components. This was possible because of SAIP; i.e., McDonnell-Douglas simply added the desired quantities of spares to their request for quotation for production-installation components. The resulting increase was less than the price quotation for the separate spares contract, even after McDonnell-Douglas added their earnings. (Clearly, the attractiveness of SAIP from the point

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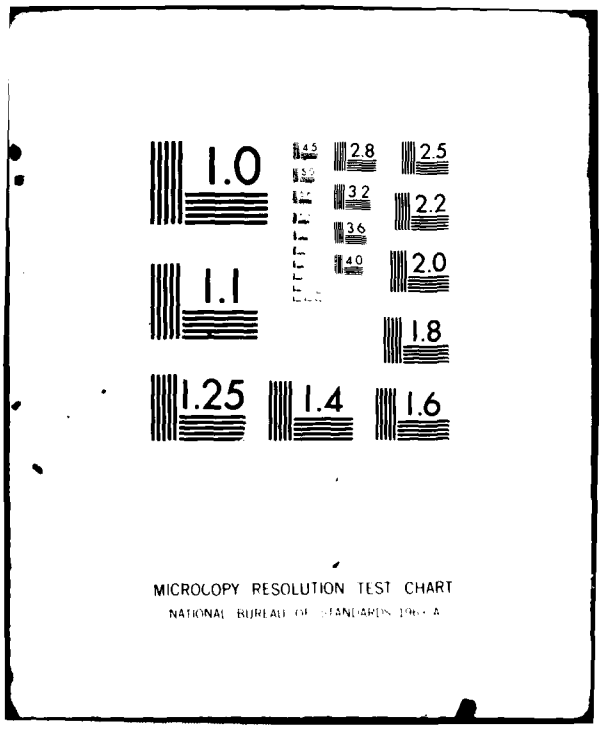
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of cost may vary dramatically from one prime contractor to another because of differences in their pricing policies, some of which add G&A and overhead to spares prices.) This suggests that the concept of break-out needs to be reexamined in the face of SAIP as an alternative. Note that we are not suggesting that break-out does not generally result in cost savings vis-a-vis procurement through the prime contractor, only that break-out in a SAIP context may inhibit cost-effective spares acquisition.

Shipsets vs. LRUs and SRUs

There has been some confusion in the various programs as to the applicability of SAIP to lower-indenture items such as SRUs. From two programs we heard that SAIP could be applied only to those items that were identical to those being bought for production installation purposes. Thus, if the contractor installed radars, the program management felt it had to procure whole radar sets, not the LRUs and SRUs for which the Service had computed requirements. This erroneous belief emerged, we believe, from wording in AFR 800-26 (and previous guidance from AFLC) requesting that the SAIP item prices be consistent with those of the identical items for production installation. This has been interpreted by many to mean that SAIP items should be identical to production items but that was never intended.

The A-10 application and the first few F-15 applications did involve identical items: LRUs and shipsets. The F-15 LRU and shipset purchases were done for economic reasons; the prime contractor simply took advantage of the opportunity for savings. The A-10 LRU purchases stemmed from an "identical item" interpretation of AFLC guidance and the fact that provisions for SAIP were not included in the contract. The F-16 application was limited to identical items because of its implementation through GD's quantity variation clauses as described in Chapter 2.

SAIP and Other Contractual Provisions

Both Reliability Improvement Warranty (RIW) and phased provisioning items can be procured under the SAIP concept. This was demonstrated on the F-16 program. The F-15 radar, also an RIW item, was also procured under the SAIP concept. Many of the F-16's SAIP items were included in a Logistics Support Cost Commitment (LSCC) contract. These three contractual provisions can be enhanced by a SAIP application.

Reliability Improvement Warranty. An RIW application normally involves a fixed population of items that are purchased, supported, and, hopefully, improved under one fixed price contract for a specified period of time. These three activities are performed by the contractor who has as his goal minimization of the purchase and support cost of the equipment so that he may maximize his profit, the difference between his RIW contract price and his actual costs. The goal of the Government is to improve the reliability of the equipment; so, a guaranteed turnaround time for repair activities is generally included in the contract with penalties in the form of an extended contract time period, the furnishing of free or reduced-price spare parts, or a decrease in the RIW contract price. RIW items are generally purchased by the contractor, and the expected cost of the items is used to compute the RIW contract price. The concurrent ordering of RIW and production items, while not explicitly required under a general RIW agreement, is required under SAIP with the resultant savings from economies of scale. SAIP can therefore be used as a method of ensuring that the portion of the RIW contract attributable to spares costs is minimal.

Phased Provisioning and SAIP. The relationship between phased provisioning and SAIP was explored in Chapter 3. We stated there that SAIP can only be applied once a decision has been made to procure. The partial

computed quantities that the service decides to buy outright thus qualify for SAIP. The contractual provisions present with SAIP can protect the Government, to a large extent, against the risk of obsolescence and configuration uncertainties which are the major reasons behind the conservatism in DoD policy. Care should be taken that the use of SAIP does not encourage provisioners to take unwarranted risks and procure total quantities, where phased provisioning might otherwise be indicated. The initial provisioning period is a period of changing configurations, and SAIP can only protect the Government up to the delivery date of the support items. Changes occurring after delivery of a quantity of items may be reflected in the next SAIP delivery, but the spares already delivered, though in the proper configuration at the time of their delivery, may have to undergo costly modification or retrofit at a later date. SAIP should not be thought of as a substitute for phased provisioning, but rather as a complementary alternative spares management technique.

Logistics Support Cost Commitment. The Air Force has devised the LSCC which is a contractual technique whereby the contractor is given the opportunity to trade off purchase prices, support activities, and costs in an attempt to meet a target LSC (TLSC) goal. This TLSC represents the total ownership costs of the items for a specified period of time. The goal of the LSCC is to give the contractor visibility over those elements of ownership costs in which he can effect changes, such as reliability, maintainability, unit prices of support items, maintenance costs, and repair times. The contractor trades these elements off against one another in an attempt to stay with the TLSC. If ownership costs exceed the TLSC for the period, the difference can either be made up by the contractor alone, or some sharing of the excess costs may take place. SAIP can aid in allowing for reduced unit costs of the spares.

6. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY OF FINDINGS

SAIP, the concurrent ordering of spares and production installation items, has been found to be a cost-effective spares acquisition strategy. As defined, SAIP is only applicable to a program whenever there is a "hot" production line--thus SAIP has applicability to both new end-item programs and modification programs. An important benefit of a proper SAIP application is the consistent pricing of spares and related production installation items, perhaps putting an end to the "buying-in" that seems present in many programs.

SAIP savings are difficult to quantify. There are three primary reasons for this: (1) estimates of SAIP savings are just that, estimates, and are subject to change each time a SAIP item price is changed; (2) design changes and engineering changes impact spares prices and production installation item prices differently; and (3) there has been no controlled test (and perhaps never can be) to compare the total cost of a SAIP strategy of concurrently ordering spares and production installation items with the conventional strategy of ordering spares separately from production installation items. We have found that the prices the Government pays for spares and production installation items cannot, in general, be identical since the contractor's loadings (such as general and administrative charges, procurement expense, and profit) are not the same for each type. None of the past SAIP applications have contained clauses ensuring that the prices for the spares and related production installation items remain on a par with price estimate, through negotiation and re-negotiation of the price, until the time the final prices are definitized.

The risk inherent in SAIP procurements derives mainly from the ordering of SAIP spares prior to when they would be ordered on a PLT-away basis. The tendency towards early ordering is greater during the initial few years of production while production processes are being smoothed out and tends to disappear when production is in full swing. Prime contractors tend to order material for their production needs so as to minimize their work-in-process inventory. It is generally the case that the Government requires spares for lay-in purposes prior to receipt of the end item; therefore, with production processes involving short flow times (for example, four to six months for tactical fighter airplanes) SAIP does not result in much risk from ordering earlier than PLT-away.

The use of SAIP decreases the amount of uncertainty contractors have concerning the timing and size of Government spares orders thereby allowing manufacturers to make more efficient decisions concerning production planning and raw material buys. Since the vendors receive the Government's orders for spares directly from the prime contractor, the "hassle" of dealing with the Government directly, often criticized by vendors, especially small businesses, is minimized.

Current DoD provisioning policy encourages PLT-away spares procurements, although the policy is flexible enough to allow for SAIP. The same cannot be said about current DoD funding policy. We have found the funding policy to be vague and unclear about how long-leadtime spares, in general, are to be funded.

SAIP has not been applied effectively for replenishment spares purchases. In fact, we observed that, even when Air Force item managers were provided with a schedule of prime contractor drop dates with their suppliers, the item managers did not attempt to time the order for spares concurrently so as to

realize cost savings from economies of scale or production learning. This was the result of both insufficient guidance and the PLT-away policy to which item managers try to adhere.

CONCLUSIONS

The most important conclusion of this work is that SAIP, as we have defined it, makes eminently good sense during the initial provisioning process, and may, in fact, remain cost-effective throughout the period of end-item production.

Further, we conclude that:

- SAIP can result in lower basic unit prices for spares, but the ultimate magnitude of savings depends upon (1) the pricing practices of the prime contractor, (2) the management of configuration change (ECP and DCN) charges, and (3) the responsiveness of the prime contractor and suppliers.
- SAIP items do not, in general, have to be ordered significantly farther in advance than conventional leadtime-away procurements.

Readiness

We have found that proper exercise of the contractual clauses present in SAIP contracts necessarily results in intensive management of the SAIP items. We therefore conclude that:

- The use of SAIP improves the support posture of the weapon system.
- Unique SAIP clauses, when properly managed, have potential readiness benefits not usually present with conventional provisioning.
- SAIP configuration and proration clauses reduce the risk of receiving obsolete items.

Current DoD Policy

We found various interpretations among the services of DoD policy concerning the obligation of funds for spare and repair parts, both for procurement-leadtime-away ordering dates and for earlier-than-leadtime-away procurements. The Navy, for instance, felt that it could not order its F/A-18

longest-leadtime spares because the indicated order dates preceded the program approval date. Other interpretations of the directives abound, even within DoD.

We conclude that:

- Current DoD policy inhibits the application of SAIP to initial provisioning by encouraging leadtime-away procurements.
- Current interpretation and implementation of policy can result in the postponement of procurement actions for spares to the detriment of the readiness of the end items.
- There does not currently exist a policy outlining the procedure for the procurement of spares where their timely delivery necessarily involves the obligation of initial spares funds prior to the formal approval of the program.

RECOMMENDATIONS

SAIP should be considered as an alternative initial provisioning strategy for all weapon system programs. SAIP should be thought of as an alternative spares procurement and management technique thereby placing it along with phased provisioning, reliability improvement warranties, full interim contractor support, and other management and procurement practices currently in use within the Services. Clearly, the decision process involved in deciding upon a SAIP application is not unlike that used for the aforementioned DoD programs and practices.

We recommend that OSD(MRA&L) modify DoDD 4140.40 by adding the following to paragraph IV. B.9 [3;3]:

> To program the use of contractors' in-production capabilities to assist in initial supply support through the application of phased provisioning techniques ... and such other management techniques as may be developed to reduce initial investment cost ... << One such management technique is the concurrent ordering of spares and production installation items when such concurrency can be economically justified or is justifiable for support considerations, that is, the timely availability of the spares.>>*

* The LMI addition falls within the "<<" and ">>" signs.

We further recommend that OSD(MRA&L) add the following supporting objective to DoDD 4140.40, Section IV. B:

> To take calculated risks during the initial support period by the procurement of quantities, not in excess of computed requirements, of selected spares in advance of the individual items' procurement leadtime to take advantage of economies resulting from concurrent procurement of production installation items and related spares.

Continued use of SAIP, after the initial support period, should depend upon (1) an economic analysis of SAIP and alternative provisioning strategies, (2) the ability of the supplier or design control activity to meet spares delivery schedules, (3) the degree of uncertainty surrounding the design stability of the procured items, (4) the ability of the Government to manage the spares procurement program effectively (including the timely authorization to manufacturers to incorporate design changes into equipment), and (5) the military essentiality of the end item. Thus, the decision to continue the use of SAIP depends on many, if not all, of the ingredients the Services use in deciding whether to break out equipment from the prime contractor, either for competition or for direct purchase from the manufacturer.

We recommend that the vague wording contained in DoDD 7200.4 concerning the disposition of funds for initial support items be clarified to eliminate the various interpretations now present among the Services.

A WORD ON IMPLEMENTATION

It is virtually impossible to quantify all of the factors bearing on the decision to implement SAIP or not in a particular weapon-system acquisition program. Therefore, the decision will ultimately be made without complete information. What can be done is to quantify the costs associated with having the prime contractor place and administer the SAIP orders. Since each contractor has his own pricing policies, it is important to understand what costs the Government will incur by implementing SAIP with a particular contractor.

Given that those costs are known, it may very well be obvious whether or not SAIP would be cost-effective. If the costs are roughly what the savings from SAIP can reasonably be expected to be, then the cost-effectiveness of a SAIP strategy is not obvious, and the decision must be largely intuitive. Our own intuition strongly suggests that, if a prime contractor adds only a "fair and reasonable" profit to his costs for administering SAIP, it would be very rare that a major weapon-system acquisition program would not profit substantially from SAIP.

APPENDIX A. GLOSSARY OF TERMS

Contractor Furnished Equipment (CFE). Those production installation items purchased by the prime contractor for use on the production line.

Contractor Furnished Spares (CFS). Those spare and repair parts purchased through the prime contractor by the Government.

Demand Development Period (DDP). The DDP is that period of time extending from the introduction of a new end item to a time beyond POC date when requirements are forecast based entirely upon actual demands or other empirical data indicative of the need for spare and repair parts.

Design Control Activity (DCA). The activity having responsibility for the design, preparation, and maintenance of engineering drawings and other technical data for a given spare part. The design control activity may be a prime contractor, a Government activity, a vendor, or others.

End Item. A final combination of end products, component parts, and/or materials which is ready for its intended use; e.g., ship, tank, mobile machine shop, aircraft.

Initial Operational Capability (IOC). The first attainment of the capability to employ effectively a weapon, item of equipment, or system of approved specific characteristics, which is operated or manned by an adequately trained, equipped, and supported military unit or force.

Initial Outfitting/Lay-in. The positioning of support items at user levels and at intermediate supply and maintenance levels as initial issues in anticipated support of newly deployed end items; excludes wholesale supply system stocks.

Preliminary Operational Capability (POC). The attainment of the capability for equipment or systems to be used by operational units and to function in a manner that is preliminary to, but in support of, the achievement of an Initial Operational Capability (IOC).

Procurement Leadtime (PLT). The sum of administrative leadtime and production leadtime.

Provisioning. A management process for determining and acquiring the range and quantity of support items necessary to operate and maintain an end item of materiel for an initial period of service.

Provisioning (Follow-on). Subsequent provisioning of the same end item from the same contractor.

Provisioning (Initial). The first-time provisioning for a new end item.

Repair Parts. Those support items that are coded to be not repairable (i.e., Consumable Items).

Reprovisioning. Subsequent provisioning of the same end item from a different contractor.

Spares. Those support items that are coded to be repairable (i.e., Recoverable Items).

Support Equipment. Those support items that are not an integral part of an end item but are required in the operation of the end item.

Support Items. Items subordinate to, or associated with, an end item (i.e., spares, repair parts, tools, test equipment, support equipment, and sundry materials) and required to operate, service, repair or overhaul an end item.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report concludes that Spares Acquisition Integrated With Production (SAIP) makes eminently good sense during the initial provisioning for new end-items and may remain cost-effective throughout the period of end-item production. Some of the advantages of SAIP that support this conclusion include lower unit prices for both spares and production installation items, improved configuration management, lower administrative costs, reduced setup costs, greater economies of scale, and enhanced availability of spares. The principal risk associated with SAIP is the presumed necessity for ordering spares too far

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in advance of need but, in many weapon-system acquisition programs, SAIP items do not have to be ordered significantly further in advance than conventional, leadtime-away procurements. The report recommends that SAIP receive explicit consideration for use in both initial and replenishment provisioning for all major weapon-system acquisition programs as a matter of DoD policy. It also suggests some changes to current DoD directives that now tend to inhibit or fail to encourage the application of SAIP.


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